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UNITED STATES  
DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU.

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ANNUAL REPORT

OF THE

IOWA—WEATHER AND CROP SERVICE,

FOR THE YEAR 1891.

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PRINTED BY ORDER OF THE GENERAL ASSEMBLY.

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DES MOINES:  
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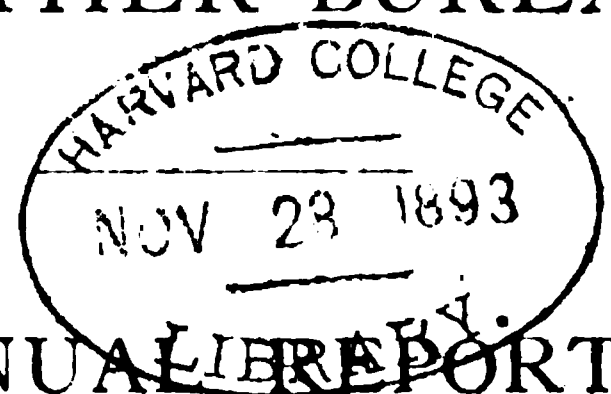
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UNITED STATES  
DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU.



ANNUAL REPORT

OF THE  
IOWA WEATHER AND CROP SERVICE,  
FOR THE YEAR 1891.

J. R. SAGE,  
Director.

GEO. M. CHAPPEL, M. D.,  
Local Forecast Official, U. S. Weather  
Bureau, Assistant Director.

DES MOINES:  
G. H. RAGSDALE, STATE PRINTER,  
1892.



**STATE OF IOWA,  
OFFICE OF THE IOWA WEATHER AND CROP SERVICE, }  
*Des Moines, October 1, 1892.***

*To his Excellency, HORACE BOIES, Governor of Iowa:*

**SIR:** In accordance with the requirements of the law, I have the honor to submit herewith the second annual report of the Iowa Weather and Crop Service for the meteorological year 1891, and including the expenditures of this service for the year ending June 2, 1892. I am, sir, very respectfully,  
your obedient servant,

**J. R. SAGE, *Director.***



## STATIONS AND OBSERVERS.

During the year 1891 the number of meteorological observers connected with this Bureau was increased from 49 to 91, and their stations were fairly well distributed over the State. From the monthly reports of these trained and intelligent observers, aided by standard instruments for recording temperature and precipitation, the accompanying weather tables have been compiled.

In addition to the above the volunteer corps of the State service includes 69 Weather Crop observers, and over 1,000 crop correspondents, whose weekly and monthly reports have furnished the basis for the Weather Crop Bulletins and the monthly estimates of the condition, acreage and average yield of the staple crops of the State. Their faithful work is highly appreciated by all who see and read the weekly and monthly issues of this Bureau.

Following is a list of stations equipped with meteorological instruments, and the names of voluntary observers from whom reports of temperature and rainfall were received during the year:

STATION.	COUNTY.	OBSERVER.
Alta .....	Cherokee .....	H. H. Peterson.
Alta .....	Cherokee .....	D. E. Hadden.
Amana .....	Iowa .....	Conrad Schadt.
Ames .....	Story .....	Prof. J. C. Halner.
Atlantic .....	Cass .....	J. W. Love.
Audubon .....	Audubon .....	H. D. Miller, M. D.
Bancroft .....	Kossuth .....	H. N. Renfrew.
Bedford .....	Taylor .....	W. F. Evans.
Belle Plaine .....	Benton .....	H. W. Vandike.
Blakeville .....	Black Hawk .....	James Rodgers.
Blockton .....	Taylor .....	C. W. Thompson.
Bonaparte .....	Van Buren .....	Hon. B. R. Vale.
Carroll .....	Carroll .....	Moses Simon.
Cedar Falls .....	Black Hawk .....	Prof. A. C. Page.
Cedar Rapids .....	Linn .....	H. D. Olds.
Charles City .....	Floyd .....	J. W. Smith.
Clarinda .....	Page .....	A. S. Van Sandt.
Clinton .....	Clinton .....	Luke Roberts.
College Springs .....	Page .....	A. A. Berry.
Concord .....	Hancock .....	J. M. Elder.
Cordova .....	Marion .....	E. S. Bearden.
Corning .....	Adams .....	John W. Bixby.
Corning .....	Adams .....	Jerome Smith.
Corydon .....	Wayne .....	J. S. Whittaker.
Cresco .....	Howard .....	Gregory Marshall.
Dallas Center .....	Dallas .....	John Fox.
Davenport* .....	Scott .....	F. J. Walz.
Delaware .....	Delaware .....	Wm. Ball.
Denison .....	Crawford .....	A. Vogeli.
Des Moines* .....	Polk .....	Geo. M. Chappel.
Dubuque* .....	Dubuque .....	S. O. Emery.
Eagle Grove .....	Wright .....	C. A. Schaffter.
Elkader .....	Clayton .....	G. A. Fairfield.
Fairfield .....	Jefferson .....	J. Fred Clarke, M. D.
Fayette .....	Fayette .....	R. Z. Latimer.
Fontanelle .....	Adair .....	W. H. Bridgeman.
Ft. Madison .....	Lee .....	Miss L. A. McCreedy.

STATION.	COUNTY.	OBSERVER.
Galva.....	Ida.....	Dr. D. W. Farnsworth.
Glenwood.....	Mills.....	Seth Dean.
Grand Meadow.....	Clayton.....	F. L. Williams.
Greenfield.....	Adair.....	J. G. Culver.
Greenville.....	Olay.....	E. E. Strawn.
Grinnell.....	Poweshiek.....	Prof. S. J. Buck.
Grundy Center.....	Grundy.....	Chas. G. Rogers.
Hampton.....	Franklin.....	E. O. Grenelle.
Havelock.....	Pocahontas.....	P. H. Coquillette.
Hawkeye.....	Fayette.....	J. W. Bopp.
Hopeville.....	Clarke.....	M. T. Ashley.
Hopkinton.....	Delaware.....	Theo. Marks.
Humboldt.....	Humboldt.....	Miss Florence Prouty.
Independence.....	Buchanan.....	E. F. Wulfke.
Indianola.....	Warren.....	Prof. J. L. Tilton.
Iowa City.....	Johnson.....	Prof. A. L. Arner.
Keokuk*.....	Lee.....	Fred Z. Gosewisch.
Keosauqua.....	Van Buren.....	Prof. J. H. Landes.
Larrabee.....	Cherokee.....	H. B. Strever.
La Crosse, Wis.*.....	.....	W. U. Simons.
Logan.....	Harrison.....	Mrs. M. B. Stern.
Mason City.....	Cerro Gordo.....	Edw. E. Wilcox.
Manson.....	Calhoun.....	W. L. Thompson.
Marshalltown.....	Marshall.....	Chas. R. Brown.
Maquoketa.....	Jackson.....	Dr. A. B. Bowen.
Maxon.....	Monroe.....	Geo. Price.
McCausland.....	Scott.....	Miss Ruby Pearl Barr.
Moorar.....	Lee.....	F. G. Thomas.
Monticello.....	Jones.....	Henry D. Smith.
Mount Vernon.....	Linn.....	Prof. A. Collin.
Mount Pleasant.....	Henry.....	G. S. Helphrey.
Mount Pleasant.....	Henry.....	Max. E. Witte.
Murray.....	Clarke.....	A. W. Lewis.
Muscatine.....	Muscatine.....	J. P. Walton.
Omaha, Neb.*.....	.....	L. A. Welsh.
Osage.....	Mitchell.....	G. D. Pattingill.
Oskaloosa.....	Mahaska.....	Joe. Boyd.
Panama.....	Shelby.....	Wm. J. Wicks.
Richland.....	Keokuk.....	Wm. A. Shaffer.
Rock Rapids.....	Lyon.....	D. E. F. Merrill.
Ruthven.....	Palo Alto.....	E. P. Barringer.
Sanborn.....	O'Brien.....	T. D. White.
Sioux City*.....	Woodbury.....	U. G. Pursell.
Stillson.....	Hancock.....	Wm. Ward.
Storm Lake.....	Buena Vista.....	A. J. Bond.
Tipton.....	Cedar.....	J. M. Rider.
Vinton.....	Benton.....	T. F. McCune.
Washington.....	Washington.....	Wm. A. Cook.
Waukon.....	Allamakee.....	H. G. Grattan.
Webster City.....	Hamilton.....	C. M. Trumbauer.
Winterset.....	Madison.....	Will McKnight.
West Bend.....	Palo Alto.....	Phil. Dorweller.
Williams.....	Hamilton.....	M. L. Fuller.

\* U. S. Weather Bureau Stations.

#### PUBLICATIONS.

Twenty-five weekly Weather-Crop Bulletins were issued during the crop season, between April 1st and October 1st. The total number of copies distributed during the season was about 32,500—a weekly average of 1,300. The summaries of these Bulletins were copied into the leading daily and weekly papers of the State, and were also circulated through the country by associated press and special dispatches. Many evidences have been received that these weekly crop reviews are highly appreciated both by the farmers and dealers in farm products.

The total number of copies of the Monthly Review distributed during the year was 20,400. The law provided for the printing and free distribution of 1,000 copies per month of this publication; but the demand greatly exceeded that number, and the cost of the excess was paid from the appropriation for support of the service. In addition to monthly meteorological tables and

records a large number of articles of scientific and practical value were published in this magazine during the year.

#### MONTHLY CROP REPORTS.

About June 1st the first regular monthly crop report of the season of 1891 was tabulated from the blanks returned by the crop correspondents of this Bureau, showing the comparative acreage and conditions of the staple farm products of the State. Monthly reports were also issued the first of July, August, October and December. These reports were published in the Monthly Review, and were widely disseminated through the press and other channels of communication to the public.

The high value of this class of reports is too well known and appreciated to require extended remarks. The output of the harvest fields attested the reliable character of the monthly estimates made during the growing season by this well trained corps of observers.

#### DISPLAY STATIONS.

Daily weather forecasts are widely disseminated through the State by means of the daily press; and in addition thereto display stations have been established at all places where there is a public demand. The forecasts have been sent free of cost to such points, the only condition imposed upon the people being that they shall provide the flags and appoint displaymen to see that the signals are hoisted on receipt of the daily telegrams. The percentage of verifications of forecasts has been very high, and this branch of the service is highly esteemed by all who have intelligently observed its operation. The National Weather Bureau has been very liberal in extending to the people of this State all possible benefits to be derived from the dissemination of its daily weather bulletins.

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#### GENERAL REVIEW OF THE YEAR.

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The year 1891 was exceptionally favorable for the leading industry of the State, and for the promotion of the public health and comfort. The winter was generally mild, and free from storms of great severity. The spring, though somewhat late, was sufficiently warm and dry for seeding operations, and moist enough to favor the germination and vigorous growth of all plants. The summer was sufficiently cool for the comfort of man and beast, and warm enough to push the crops forward to maturity. The early autumn was phenomenally warm, and abundant time was given for the perfect ripening of all crops before the coming of killing frosts.

It was a year of greater productiveness of staple farm crops, and of the fruits of the orchards and vineyards, than had been enjoyed by the people of Iowa within the past quarter of a century; and following a year of drought and exceptional scarcity it brought needed relief and prosperity to all industrial classes.



The mean temperature for the State, for the year 1891, was  $47.4^{\circ}$ , which is about the normal, as shown by the records of the past twenty years. The range was from  $42^{\circ}$  in the extreme north, to  $52^{\circ}$  in the southeast and southwest. The highest temperature recorded was  $106^{\circ}$  at Blakeville, August 9th, and at Glenwood, August 7th. The lowest was  $81^{\circ}$  below zero at Cresco, February 4th.

The average precipitation (rain and melted snow) was 33.13 inches—about 2 inches below the yearly normal. The range was 23.48 at Fort Madison, to 49.05 inches at Alta, in Buena Vista county. The chart will show the heaviest measurements in Cherokee and Buena Vista counties, and in adjoining counties of the Northwest and North Central districts. The larger part of the State received less than the normal amount for the full year, but in all portions there was an abundance during the crop season to secure ample results in the form of crops.

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## MONTHLY WEATHER REVIEW.

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### JANUARY.

**BAROMETER.** The mean pressure for the month was 30.117 inches; highest observed, 30.720 inches at Cresco on the 7th; lowest, 29.170 inches on the 1st at Keokuk. Range for the State, 1.550 inches.

**TEMPERATURE.** The records show that this was the warmest and fairest January within the last decade. There was throughout the State an average daily excess of  $10^{\circ}$  of temperature, and there was a remarkably high percentage of clear and fair weather. The monthly mean for the State was  $26^{\circ}$ . Highest monthly mean,  $31.6^{\circ}$ , at Keokuk; lowest,  $20^{\circ}$ , at Manson. The highest temperature reported was  $58^{\circ}$ , at Sioux City on the 19th; lowest— $4^{\circ}$  on the 12th and 31st, at Manson and Bancroft. The average monthly range for the State was  $43.2^{\circ}$ .

**PRECIPITATION.** Average for the State 1.75 inches, ranging in its distribution from .61 of an inch, at Fort Madison, to 3.99 inches at McCausland. The greatest amount of snowfall reported was 16.4 inches at Sioux City. Over the State, as a whole, the average snowfall was unusually light.

**MISCELLANEOUS.** The prevailing direction of the wind was northwest. The maximum velocity was 37 miles an hour, at Sioux City on the 1st.

### EXTRACTS FROM OBSERVERS' NOTES.

*Hesper*—G. E. DILLINGHAM. On January 29th there were nine inches of snow on the ground, heavy with rain. I came to Iowa in December, 1865, and have not witnessed so even, calm and beautiful snowfall in Iowa.

*Storm Lake*—A. J. BOND. The month came in with a snow storm and went out with a snow storm; but for three weeks previous to the 28th the weather was warm, the roads dry and smooth and wheeling excellent. The thermometer has not been below zero until the evening of the 31st.

*Williams*--M. L. FULLER. The total precipitation during January was 1.93 inches, of which 1.56 inches fell in the 24 hours ending at 7 A. M. the 29th. Included in the total precipitation was 5.61 inches of snow.

*Logan*--MRS. M. B. STERN. The month was unusually pleasant, ground dry and dusty most of the time. Wild geese went north on the 18th, and robins and pewees were observed on the 19th and 20th. No wind storms and but little snow.

*Fort Madison*--Miss L. A. MCCREADY. Farmers think there is a good prospect for a fair crop of winter wheat. Well water continues scarce.

*Panama*--W. J. WICKS. There was quite a blizzard of snow, wind and rain during night of December 31st and January 1st. The weather, however, was not cold, and mercury did not fall below 18°.

*Carroll*--MOSES SIMON. From the 2d to the 26th inclusive we had fine weather, except the 20th. Out-door work was done comfortably until the 27th, on which date the first sleighing of the season was had.

#### FEBRUARY.

**BAROMETER.** The mean atmospheric pressure for this month was 30.065 inches. The highest recorded was 30.65, at Clarinda, on the 28th and the lowest, 29.135, at Des Moines, on the 24th. Range for the State, 1.535 inches.

**TEMPERATURE.** February brought its quota of normal winter weather, the mean temperature of the month being 19.4°, which is 6.6° lower than the mean of January. The records at Des Moines show that of the corresponding months during the past decade there have been six warmer and four colder. The coldest periods during the month were about the 3d and 4th, and the 28th, on which latter date the lowest temperature, 31° below zero, was recorded at Cresco. The highest monthly mean was 29.6° at Fort Madison, and the lowest, 8.4° at Larrabee. The highest temperature reported was 70°, on the 24th, at Keokuk.

**PRECIPITATION.** The average for the State was 1.16 inches, coming mainly in form of snow and quite generally distributed. About fifty per cent of the days were cloudless, and in general it was a very favorable winter month. The greatest amount of precipitation was at Manson, 2.41 inches,—the snow-fall measuring 18.8 inches.

**MISCELLANEOUS.** Prevailing direction of wind, northwest; maximum velocity, 44 miles an hour, on the 24th, at Sioux City. Average number of cloudy days, 7.9; cloudless, 13.2; partly cloudy, 6.8. Thunder storms occurred on 23d at Bancroft, and on the 24th at Concord, Manson, Stilson, Webster City, West Bend, and Williams.

#### EXTRACTS FROM OBSERVERS' NOTES.

*Carson*--G. N. FERGUSON. Very disagreeable weather prevailed in this vicinity during the month, the thermometer registering 13° below zero on the 28th. The roads at times were almost impassable. North wind prevailed, with 17 clear, 6 fair and 5 cloudless days. Mock suns were observed on the 1st, 2d, 8th and 9th.

*Alta*--DAVID E. HADDEN. Aurora Borealis observed on the 9th. First noticed about 7:00 P. M., extending from N. N. W. to N. N. E. At 7:45 P. M. it was about 15° in altitude, and brighter with dark segment. At 8:30 P. M.

the meteor had vanished, but a faint glow continued until late. An extensive group of sun spots, which were not visible on the 9th, appeared on the sun when I took an observation the day following. The solar disturbance unquestionably caused a simultaneous disturbance in terrestrial electrical currents; hence the aurora.

*Manson*—W. L. THOMPSON. February 24. Very remarkable weather, thunder and lightning in the early morning with heavy rain. Dense fog until about 10:00 A. M. Wind, which had been S. E. by S., turned suddenly to W., then to N. W., getting very cold. Wind velocity 35 to 40 miles per hour, with light snow blizzard. Mercury fell  $46^{\circ}$  in 8 hours.

*Glenwood*—SETH DEAN. A flock of robins have remained with us all winter; wild geese have been quite plenty, passing both north and south during the month. The ground is frozen about 14 inches.

*Logan*—MRS. M. B. STERN. February was our wintry month, the first and last days being the coldest of the winter. Very bright "sun dogs" were seen on the 24th and 26th. Still we have had no bad storms and but little drifting snow.

*Williams*—M. L. FULLER. The storm on the 8th was followed by a strong S. W. wind, which blew from 7:00 P. M. on the 8th to 8:00 A. M. on the 9th, the mercury falling in that time  $22^{\circ}$ .

*Cedar Rapids*—H. D. OLDS. The thawing weather has had but little effect on the streams, as there has been but little snow on the ground during the winter. Water has risen but few inches in the river, the ice remaining firm.

*Monticello*.—HENRY D. SMITH. The maximum temperature for February since 1854, was  $60^{\circ}$  in 1877; the minimum was  $-32^{\circ}$  in 1875. Normal for the month,  $21.42^{\circ}$ . Precipitation was 4.22 inches in 1878 and 0.32 in 1877. Normal for the month, 1.92 inches. February has been pleasant, there being 16 clear days.

*Belle Plaine*.—H. W. VAN DYKE. Wild geese were observed flying north on the 13th.

*Amana*.—CONRAD SCHADT. Wild geese were observed flying northward on the evening of the 12th.

*Hopeville*.—M. L. ASHLEY. First wild ducks were observed on the 24th; also blue birds.

#### MARCH.

**BAROMETER.** The mean temperature for the month was 30.587 inches. The highest observed was 30.59 inches, at Davenport, on the 1st; lowest, 29.33 inches, at Mt. Vernon, on the 31st; range for the State 1.26 inches.

**TEMPERATURE.** March maintained its general character as a winter month. The mean temperature for the State was  $26.8^{\circ}$ , which was only  $0.8^{\circ}$  higher than the mean of January. It was the coldest and generally most disagreeable March that had been experienced in Iowa within fifteen years. The average daily deficiency of temperature was  $5.3^{\circ}$ . But at the close of the month the excess of temperature, since Jan. 1st, amounted to  $165^{\circ}$ . The highest monthly mean was  $34.4^{\circ}$ , at Fort Madison; lowest,  $22^{\circ}$  at Williams.

**PRECIPITATION.** The average for the State was 2.60 inches, which is about 0.47 of an inch above the normal. The greatest amount reported was 4.58 inches at Fairfield; least amount, 1.33 at Storm Lake. The heaviest

precipitation in one day was 1.50 inches at Iowa City, on the 8th. The heaviest snowfall was 82.5 inches at Fairfield; least amount 8 inches at Bancroft and Storm Lake.

**MISCELLANEOUS.** The prevailing direction of wind was northeast, indicating the continuous southward trend of storm movements. The maximum velocity reported was 38 miles an hour, at Davenport, on the 30th. Hail fell quite generally on the 29th, and thunder storms were reported from thirty-six stations on the same date.

#### EXTRACTS FROM OBSERVERS' NOTES.

**Monticello.**—HENRY D. SMITH. There was an unusual amount of cloudy weather and northeast wind during March. The maximum temperature for this month since 1854, was 78° in 1875, and the minimum—16° in 1890. Highest mean, 45.8° in 1878 and lowest mean, 24.06° in 1857. The normal mean of the month is 32.18°, and March, 1891, was 5.09° below normal. The highest precipitation was 6.54 inches in 1877; lowest 9.07 in 1869. The maximum snowfall was 26.6 inches in 1876, and the minimum 0.00 in 1877.

**Cedar Rapids.**—H. D. OLDS. The ice broke up in Cedar river on the 28d. Water has not been high enough to do any damage. Frost is about all out of the ground, and the country roads are about impassable.

**Oskaloosa.**—JOS. BOYD. March was a stormy month. On evening of the 29th at 9:00 o'clock, we had a hail storm, with sharp lightning and heavy thunder. Hail stones size of peas came from the south; not much wind.

**Belle Plaine.**—H. W. VAN DIKE. First thunder storm of the season was on evening of March 27th. It was preceded by a high southwest wind, the storm coming from northwest. Hail covered the ground, largest half an inch in diameter. A flock of wild geese became bewildered during the storm and circled around the electric lights with hideous croaking. Blue-birds appeared on the 22d, and robins on the 30th. Ground was frozen during the winter ten to sixteen inches. A brilliant parhelia was observed on morning of the 4th. It appeared in two segments of a circle, with a radius of 22½°, each segment about 10° of circle, and exhibiting colors of the rainbow.

**Hampton.**—E. E. GRENELLE. The first flight of wild geese and ducks observed on 22d. On evening of 29th there was a hard thunder storm, with bright lightning for an hour.

**Carroll.**—MOSES SIMON. The season is considered two to three weeks late. There were many cloudy days and little sunshine during the month. No seeding reported yet.

**Panama.**—WM. J. WICKS. Snow is all gone, except remains of drifts. Frost nearly out of ground, and farmers will soon begin seeding if weather clears up. March was a cloudy, disagreeable month.

**West Bend.**—P. DORWEILER. An unpleasant month. Snow is mostly gone; sloughs and creeks are mostly full of water; ground not yet fit for farm work.

**Larrabee.**—H. B. STREVER. Cloudiness prevailed generally during the month, the sun scarcely being seen after the 22d. Wild geese and ducks were first seen on the 19th, going northward. Robins came the 28th.

**Storm Lake.**—A. J. BOND. The temperature has been five-tenths of a degree warmer than March last year, and the snow was gone at close of

month. Last year the heaviest snow storm came on the 28th of March. The month was characterized by frequent light snow storms and much cloudy weather. No rain except about half an inch on the 29th and 30th.

*Hopeville.*—MILTON T. ASHLEY. Some frost still in the ground. Roads terribly muddy. Also the fields. No farm work done yet. Vegetation not started. Cloudy weather nearly all the time. Indications are for a very late spring.

*Indianola.*—PROF. J. L. TILTON. The first thunder storm of the season occurred on the 29th. Thunder was heard and lightning observed in the southwest and west at 8 P. M. and later.

*Fort Madison.*—MISS L. A. MCCREADY. Blue birds arrived on the 17th, robins on the 18th, and larks on the 30th. People are making gardens in town, but not in the country.

*Bancroft.*—H. N. RENFREW. March has been cold and chilly; snow remains near fences and where it had drifted. No grain sown yet. Frost not out of the ground.

*Alta.*—D. E. HADDEN. The mean temperature of March was  $24^{\circ}$ . Maximum on the 22d,  $50^{\circ}$ —minimum on the 4th— $10^{\circ}$ . Total precipitation, 1.77. Snowfall in inches, 10 $\frac{1}{4}$ . Number of clear days, 7; partly cloudy, 9; cloudy, 15. Mean temperature of March, 1891, was nearly one-half degree warmer than the corresponding month in 1890, and the precipitation slightly deficient.

*Fayette.*—R. Z. LATIMER. The rain on the 29th was accompanied by heavy thunder. Geese, ducks, robins, and other migratory birds were seen on the 28th.

#### APRIL.

**BAROMETER.**—The mean pressure for the State was 30.014 inches; highest observed, 30.51 inches, at Sioux City and Omaha, on the 4th; lowest, 29.46 inches, at Bancroft, on the 29th. The range for the State was 1.05 inches.

**TEMPERATURE.**—The mean temperature of the month,  $50.6^{\circ}$ , was  $2^{\circ}$  above normal. During the first half of the month there was a prevalence of cool, damp and cloudy weather, which retarded farm operations and the growth of vegetation. The latter half brought more favorable conditions of heat and moisture, giving a remarkable impetus to plant growth and greatly improving the crop situation.

On the whole, the month was favorable, and there has been but one warmer April within the past decade, and that was in 1890. The highest monthly mean was  $55.9^{\circ}$ , at Fort Madison, and the lowest,  $46.3^{\circ}$ , at Osage. The highest temperature reported was  $93^{\circ}$ , at Sioux City, on the 29th, and the lowest was  $18^{\circ}$ , at Larrabee, on the 4th. The average monthly range was  $62.4^{\circ}$ .

**PRECIPITATION.**—The average was 2.15 inches; but two-thirds of the State received more than the normal amount. The greatest amount reported was 5.06 inches, at Keokuk; least amount, 0.59 of an inch, at Webster City. The heaviest daily rainfall was 1.46 inches, at Fayette, on the 20th. The greatest snowfall was 2.5 inches, at Bedford. Precipitation occurred at some point within the State on every day of the month except the 5th, 24th, 25th, 26th and 27th.

**MISCELLANEOUS.**—The prevailing direction of the wind was northwest; highest velocity recorded, 53 miles an hour, on the 16th, at Sioux City. The

average number of cloudy days was 9.2; partly cloudy, 7.4; cloudless, 13.7. Hail is reported to have fallen at Murray on the 8, 16; Fontanelle, 8; Atlantic, 8; Alta, 12, 16, 22; Des Moines, 8; Fort Madison, 17; Webster City, 8; Larrabee, 8, 16; Independence, 16; Hopeville, 8, 9, 13.

Thunder storms are reported to have occurred at various places on the 8, 9, 10, 12, 13, 14, 16, 17, 20, 21, 29, 30.

#### EXTRACTS FROM OBSERVERS' NOTES.

*Des Moines* (5½ miles S. E.)—A. VOGELI. Thunder storms occurred on the 8th, 9th, 12th, 13th, 16th, 17th and 29th, and distant thunder was heard on the 20th. On the 25th Juneberries were in full bloom. On the 30th plum and cherry trees were in bloom.

*Belle Plaine*.—H. W. VAN DIKE. Soft Maple trees were in bloom on the 12th; Cottonwood and Box-Elder on the 19th. Early cherry trees and plum trees were in full bloom on the 29th.

*Cedar Rapids*.—H. D. OLDS. No frost was observed after the 12th. Water in the Cedar river is about at its usual stage at this time of the year. Fruit trees were in full bloom some days before the close of the month; grass and grain are looking well.

*Sanborn*.—T. D. WHITE. Stock is getting a very good living in pastures. A large acreage of small grain is sown and looking well. About one-third the acreage of corn was planted; and some planted on the 26th was sprouted at close of the month.

*Alta*.—DAVID E. HADDEN. The precipitation and mean temperature of April, 1891, were about the same as the corresponding month in 1890. Compared by decades (noon observations) the mean temperature of the month was nearly 2½° colder. The first decade was coldest, being 10½° colder, and the last decade the warmest, being 8° warmer than the same periods last year.

○ *Fayette*—R. Z. LATIMER. On the 8th we had our first and only thunder shower during April.

*Fort Madison*—MISS L. A. MCCREADY. Maple leaves were out April 21st. Plums and apples were in bloom the 28th; cherries the 27th.

*Logan*—MRS. M. B. STERN. During the last half of the month there was a remarkable development of leaf and blossom of fruit trees, and nearly all were in bloom by the 28th. Grass made rapid growth.

*Indianola*—J. L. TILDEN. During a thunder storm on the 16th two cows belonging to Mr. Brandt, seven miles northwest of here, were killed by lightning. A thunder storm with a strong southwest wind, on evening of the 29th. Rainfall of the month, 2.90.

*West Bend*—P. DORWEILER. The first half of April was cold and backward, and no farm work was done. The last half was warmer than usual. There were thunder storms on the 8th, 12th and 16th. Willows and Cottonwood were leafing on the 25th, and Soft Maple on the 27th.

#### MAY.

**BAROMETER.** The mean pressure for the month was 30.084 inches; highest observed 30.59 inches, at Cresco, on the 3d; lowest, 29.55 inches, at Sioux City, on the 19th. Range for the State, 1.04 inches.



**TEMPERATURE.** The mean temperature,  $58.3^{\circ}$ , was about  $2^{\circ}$  below the normal for this month. There have been three cooler Mays within the past decade, viz.: in 1882, 1883 and 1888. There were frequent light frosts throughout the month, but no very considerable damage resulted therefrom. The highest monthly mean was  $62.7^{\circ}$ , at Glenwood; lowest,  $53^{\circ}$ , at Charles City. The average monthly range of temperature was  $50.6^{\circ}$ .

**PRECIPITATION.** The average for the State was 3.18 inches, which is about 1.25 inches below the normal for the month. Greatest amount reported, 7.10 inches at Mount Vernon; least amount reported, 1.46 inches at Bancroft; at Carroll on the 30th 2.50 inches rain fell in six hours and five minutes; trace of snow at Bancroft and Larrabee; average number of days on which .01 inch or more fell, 7.5.

**MISCELLANEOUS.** The prevailing direction of the wind was northeast. Highest velocity recorded, 46 miles an hour, at Sioux City, on the 8th. Hail fell on the 3d at Windsor; on the 6th, 7th and 27th at Oskaloosa; on the 10th and 31st at Denison; on the 19th at Sanborn; on the 20th at Amana; on the 24th at Atlantic; on the 31st at Alta, Hopeville, Larrabee and Webster City.

Thunder storms occurred on the 2d, 4th, 9th, 10th, 18th, 15th, 18th, 19th, 21st, 22d, 24th, 25th, 28th, 29th, 30th and 31st.

Frosts occurred on the 1st, 2d, 3d, 4th, 5th, 6th, 7th, 10th, 11th, 16th, 17th, 18th, 22d, 23d, 25th, 26th, 27th and 28th, but no material damage resulted.

#### EXTRACTS FROM OBSERVERS' NOTES.

*Postville*—F. L. WILLIAMS. May was very dry, but what rain we had came gently, so that it was all available for the crops. On the fourth, fifth and sixth ice formed in low places.

*Logan*—MRS. M. B. STERN. The latest frost was May 17th, doing some damage to fruit. A very bright lunar halo on the 19th.

*Carroll*—MOSES SIMON. Timely rains have put all growing crops in first class condition. Plenty of small fruit and prospects of largest yield for years.

*Monticello*—HENRY D. SMITH. The mean temperature for May, 1891, was  $58.05^{\circ}$ . The maximum temperature for May since 1854 was  $102^{\circ}$  in 1856 and 1870. Minimum for same period  $25^{\circ}$  in 1885. Normal for month  $59.84^{\circ}$ . Maximum rainfall since 1854 was 7.97 inches in 1858; minimum, 0.76 in 1874. Normal rainfall, 3.85 inches.

*Des Moines*—ADOLPHUS VOGELI. On the 6th corn planting commenced and ended on the 28th. Frost on 3d and 6th damaged grapes and garden stuff. Black walnut in bloom on 10th.

*Anama*—CONRAD SCHADT. On the 20th 1.33 inches of rain fell between 5:30 and 7:45 P. M. And from 6:45 A. M. of the 20th to 11 A. M. of the 21st the rainfall was 3.98 inches.

*Cedar Rapids*—H. D. OLDS. The heavy fall of rain has affected the water in the river but slightly, showing that the ground has absorbed nearly all of the rainfall. The ground is thoroughly soaked.

*Larrabee*—H. B. STREVER. The drouth prevailed with increasing severity until the 30th. So dry a spring has not occurred before in fifteen years.

*Clinton*—LUKE ROBERTS. The temperature and rainfall of May were about normal. The first nineteen days were nearly rainless; a serious drought threatened. On the 20th relief came, and the principal precipita-



tion came on that and the day following two days. Several frosts occurred; three quite heavy. The last killing frost came on the 26th, but no serious results. The number of clear days was in excess of normal, and cloudy ones below. As to grain the season appeared to be late; but fruits and flowers were normally forward.

## JUNE.

**BAROMETER.** During the month of June low barometric conditions prevailed in Iowa and contiguous States 21 days, the mean barometric pressure being 29.89 inches. The effect was noted in the frequency of storms, and heavy local precipitation. The highest observed pressure was 30.28 inches, at Ames, on the 4th; lowest, 29.53 inches, at Clinton, on the 18th. The range for the State was 0.75 of an inch.

**TEMPERATURE.** The monthly mean temperature was 69.1°, which is about the normal. Highest monthly mean 74.8°, at Bonaparte; lowest 65.4°, at Cresco and Osage. The highest temperature reported was 99°, at Indianola, on the 24th, and the lowest, 37°, at Hampton, on the 4th.

**PRECIPITATION.** Average for the State, 5.39 inches; greatest amount reported, 19.88 inches at Larrabee; least amount reported, 1.68 inches at Hopkinton; greatest daily rainfall, 12.99 at Larrabee on the 24th; average number of days on which .01 inch or more fell, 10.8; rain fell in the State on every day of the month except the 22d.

**MISCELLANEOUS.** The prevailing direction of the wind was south. Highest velocity recorded, 52 miles an hour at Sioux City on the 26th. The average number of cloudy days was 11.7; partly cloudy, 10.2; cloudless, 8.1.

Hail fell on the 2d at College Springs, Richland and Fairfield; on the 3d at Richland; on the 10th at Fairfield; on the 16th at Alta; on the 23d at Sanborn; on the 24th at Storm Lake; on the 27th at Atlantic, Fontanelle and Greenfield; on the 28th at Charles City, Cresco, Grand Meadow, Grundy Center and Maquoketa; on the 29th at Eagle Grove.

Thunder storms occurred on every day of the month except the 4th, 7th, 8th, 13th, 22d and the 30th. Light frost at Hampton on the 4th.

## EXTRACTS FROM OBSERVERS' NOTES.

*Storm Lake*—A. J. BOND. Storm on 16th and 17th flooded crops on low ground. June 24th everything on low ground more than flooded. The bridges are gone and cellars are gradually filling with water from the saturated ground.

*Cresco*—GREGORY MARSHALL. On the 28th, about 3:40 P. M., a terrible hail storm occurred about two miles north of Cresco, passing from the southwest to the northeast, seven or eight miles in length and two miles wide. In this area several fields were devastated, window glass broken, chickens killed, and hailstones fell as large as walnuts. It was the worst hail storm ever experienced in this county.

*Amana*—CONRAD SCHADT. On the 16th during a heavy thunder storm at 1:30 to 4:25 P. M. lightning struck a house in Middle Amana, a village about 1½ miles from here. No fire, no one seriously hurt. During a severe thunder storm on the 27th lightning struck the elevator on the C., M. & St. P. Ry., and a house, doing light damage.

*Clinton*—LUKE ROBERTS. Mean temperature for the month was one degree above normal. But two Junes for the last thirteen years were warmer, viz, 1887 and 1890. Sunshine and number of clear days about normal. Water in the Mississippi river has remained rather low all the season.

*College Springs*—A. A. BERRY. June, 1891, will be remembered as a very wet month. The temperature was below the average and corn was kept back. Much damage was caused by lightning. On the 17th a water-spout struck this station at 3:15 P. M., and in 35 minutes over two inches of rain fell, causing damage by washing out corn, fences and bridges.

*Monticello*—HENRY D. SMITH. Maximum temperature for June, since 1854, 102° in 1870; minimum, 36° in 1855; normal, 68.54°. From January 1st to July 1, 1891, the total rainfall was 11.28 inches, normal, 16.80 inches.

*Cedar Rapids*—H. D. OLDS. Rainfall at this station has been just about the amount needed for growing crops. Water in the river at usual stage for the season.

*Bancroft*—H. N. BENFREW. The storm of the 24th was severe, lightning striking two houses in Bancroft. Considerable stock killed on the prairies.

*Grundy Center*—CHAS. H. ROGERS. On the 28th a severe hail storm passed through Colfax, Lincoln and Grant townships, taking a strip about one mile in width and ten miles in length, injuring oats, barley and corn. Some fields of oats and barley are entirely ruined, others are damaged from one-fourth to three-fourths. This is about two miles north of this station.

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## THE JUNE FLOODS.

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From the Monthly Review.

June is the month of the heaviest precipitation in Iowa. This year more than the normal amount came within the month, but it was not well distributed. On the night of the 23d and on the 24th the northwest district was swept by the heaviest rain storm ever known in that section. The center of the down pour was at Cherokee, where the larger measure of damage was wrought by floods. Adjoining counties were more or less affected by the deluge and accompanying wind squalls. The highest measurement reported was in Larrabee, in Cherokee county, where over thirteen inches of rain fell in less than twenty-four hours. It is probable that a greater quantity fell at or near the town of Cherokee.

H. B. Strever, of Larrabee, Cherokee county, writes: On the night of June 23d and early morning of the 24th, occurred the heaviest rainfall ever experienced in this region. Soon after mid-afternoon of the 23d a shower formed to the west of us and passed towards the northeast. Soon after another formed in the west and followed the first, a brisk south wind blowing at the time. Later a change of wind to the north turned the first back, the two coming together some miles northward, developing a wind storm which took a southeasterly course, destroying buildings in and around

Sutherland, giving us a good shower. The wind then shifted to the south-east, bringing the storm back, and at 9:13 P. M. began the down pour which continued till 8 o'clock next morning. During the greater portion of the night, livid flashes of lightning were almost incessant and at times the thunder was terrific, the wind blowing from different directions during the night, apparently carrying the storm back and forth, deluging us with water, which measured 11.75 inches in 12 hours. Creeks and streams were swollen beyond all former dimensions, sweeping away everything before them in form of bridges and houses upon bottom lands. About 50 houses were swept away in Cherokee, and as many more flooded; three dwellings and a grist mill on Mill Creek were carried away. But two of the eleven larger bridges in the county are left. The Illinois Central railroad lost heavily. No correct estimate of the damage in this county can be made. Mr. H. H. Carnahan, of Larrabee, one mile east and one-fourth mile north, says his rain guage contained 12.84 inches of water and was overflowing on the morning of the 24th. He also reports 1.60 inches of rain that fell later in the day.

The flooded districts embraced portions of Cherokee, Ida, Plymouth, Woodbury, O'Brien, Buena Vista, Osceola and Monona counties. The overflow of the little Sioux and Maple rivers ruined thousands of acres of crops.

The Cherokee *Times* gives the following account of the fearful night of the 23d and the scenes witnessed the next day:

"Probably one hundred families are homeless in Cherokee to night, the most disastrous flood in the history of this section having occurred Tuesday night. About 6 o'clock threatening clouds began to gather in the west, and at 9 o'clock a terrible rain storm commenced which lasted during the entire night.

"About 8 o'clock fireman George Thompson, who lived in the eastern part of the city, became alarmed at the ferocity of the storm, and going out, found the entire bottom upon which he lived inundated. He then called a neighbor, Owen Faus, and told him to go and ring the fire bell. This was a warning which saved many lives. The citizens responded liberally to the alarm and in a short time lanterns in the hands of those who at once realized the situation were flashing their beacon rays throughout the inundated district. Railroad creek, an insignificant stream which courses through the city, in a remarkably short time became an ungovernable, raging torrent. To add terror to the night a desperate electrical storm prevailed and the vivid flashes of lightning and deafening thunder was enough to quail the stoutest hearts. The water on what is commonly known as the bottom was rapidly rising and many brave souls were soon giving warning to the threatened inhabitants and bidding them fly for their lives.

"There was but one refuge of safety, the bridge across Main street, and soon a surging mass of humanity, flying for their lives, was pouring across, seeking safety in the higher portions of the city.

"Women in their night clothing, leading children or carrying them in their arms through the beating rain and flashing lightning, for an hour and a half continued to pour across this only refuge of safety. The rise was so rapid that it was with great difficulty, and at the risk of their lives, that many people succeeded in crossing the bridge. Three men were on the west

approach when it gave away, but by a desperate effort they managed to save themselves by clinging to the hand rail and trees near by. Many people stubbornly refused to leave their homes until it was almost too late, and those who did remain had to seek safety in the upper stories or on the tops of their houses. Some time after daylight a second heavy rain set in which rapidly swelled the already maddened torrent until it reached to the river. Many houses had gone down together with stock of all kinds, but now another danger threatened, the river began to rise. It raised six feet an hour and soon it became apparent that everything in the lower portion of the city was doomed. Buildings that heretofore had never been reached by high water were soon surrounded. A large crowd gathered at the foot of Second street, many of them pointing out their houses containing their clothing, furniture and everything they possessed in the world as they were being carried down by the flood. There were but few boats but they were manned by brave men who, at the risk of their lives, exerted every energy to save life and property. People who had refused to leave their homes were taken out of upper story windows and brought to places of safety. Eli Richardson, who was well nigh exhausted, was discovered in the branches of a tree north of the Beckwith mill and was taken in a boat by Jim Henderson and John Blodgett. Geo. Pull had \$2,000 of stock at his slaughter house and 45 head of hogs and 15 head of cattle were lost. The water works pump is under water and all the bridges have been swept away. An effort was made to save the iron bridge across the river on Second street by tearing off the planking, but soon after the work was completed the huge structure was seen to totter and fall. F. D. Yaw lost a number of fine horses, some of them having been seen tied to a portion of the stable and struggling to escape, but they were carried down with the debris. The Building and Loan Association lost 15 houses on which partial payment had been made. The amount of damage done is incalculable, but many thousands of dollars have been lost which falls principally upon those who could least afford it, they having built their homes upon the lands where lots were cheapest.

“Now that the waters have subsided one can more fully realize the terrible destruction of the flood wrought by the 24th inst. Houses and barns, out-houses, furniture, musical instruments, wagons, and everything lying in the path of the maddened waters are in many places along the Sioux river, piled in chaotic confusion. In the southeastern portion of the city where once stood the humble dwellings of the chief part of the laboring population, but few buildings escaped.

“The losses in Cherokee county are estimated at a half million dollars, and it is probable that the damage resulting from that storm will aggregate over a million dollars in all the counties affected by the floods.”

#### THE STORM AT SUTHERLAND.

The storm struck Sutherland, O'Brien county about 8 o'clock on the evening of the 23d, and at that point several funnel clouds were seen. Mr. Bert Hamilton, editor of the *Sutherland Courier*, contributes the following notes:

Six or seven funnel clouds were seen forming in the west, some bursting when they dropped to the earth, and others rebounding and doing their

work of destruction. The storm passed entirely around the business part of the town, doing its work on the outskirts north and south. The wind was blowing strongest from the southeast, but the funnels appeared to revolve from north to south. Objects left in the pathway of the storm were blown to the west on the north side and to the east on the south: no damage in the center. The width of the storm was one and a half miles, and the distance traveled was about four miles. No one was killed. Loss by wind and rain was about \$80,000 in this township (Waterman). The air was filled with electric flashes before, during and after the storm.

#### THE IDA COUNTY STORM.

On the night of June 16th and the morning of the 17th, a storm described as a "cloud burst," occurred in Ida county, and was destructive to crops, fences, bridges and live stock on the bottom lands. A portion of the town of Ida Grove was flooded, and a number of cottages were partially submerged. The amount of rainfall was variously estimated at from seven to nine inches; but no measurements are reported from observers supplied with standard rain gauges. While the aggregate of loss was considerable there were no instances of sweeping damage.

#### JULY.

**BAROMETER.** Mean pressure, 30.012 inches; highest observed, 30.40 inches, at Omaha, on the 24th; lowest, 29.68 inches, at Cedar Rapids on the 6th. Range for the State 0.72 inch.

**TEMPERATURE.** The daily average temperature was six degrees below normal, and according to the records of the Weather Bureau stations in or near the State it was the coolest July that has been known in Iowa within the past twenty years. The monthly mean for the State was 68.6; highest monthly mean, 73.6 at Fort Madison; lowest, 63.8 at Delaware. The highest temperature reported was 99 at Stilson on the 20th, and the lowest, 41 on 9th at Fayette, and on the 24th at Storm Lake.

**PRECIPITATION.** The average precipitation was 4.22 inches, which is about the normal. The greatest amount reported was 8.20 inches at Larrabee; least amount 1.67 inches at Bancroft.

**MISCELLANEOUS.** Prevailing direction of the wind, northwest; highest velocity recorded, 46 miles an hour at Sioux City on the 10th. The average number of cloudy days was 4.9; partly cloudy, 12.8; cloudless, 13.1. Hail fell on the 1st, 16th, 22d at Alta; on the 1st at Fontanelle, Grinnell and Hopeville; on the 2d at Tipton; on the 10th at Atlantic; on the 1st, 10th, 16th and 22d at Larrabee; on the 21st and 29th at Storm Lake; on the 22d at Grundy Center, Independence, Marshalltown and Williams; on the 22d and 31st at Denison; on the 28th at West Bend.

Thunder storms occurred on every day of the month except the 3d, 5th, 14th, 15th, 18th, 19th and 30th.

#### EXTRACTS FROM OBSERVERS' NOTES.

*Cedar Rapids*—H. D. OLDS. The mean temperature during the month of July has been the lowest since observations have been taken here (six years) the average having been 75°. The highest, 1887, was 77.8°, and the lowest,

1885, was 73.9°. The nights were cooler than during the month of June. Owing to abundant rains at the headwaters of the river, there has been a fair stage of water during the entire month, and wells and springs have a good supply.

*West Bend*—P. DORWEILER. On the 28th, at 7 P. M., there was a hail-storm which wrought considerable damage to crops and fruits within a track half a mile wide and not very long.

*Amana*—CONRAD SCHADT. On the 22d at 5:30 P. M., a hurricane-like storm, accompanied by a roaring sound, came from the northwest and blew furiously about five minutes, when rain began falling. The storm lasted about one-fourth of an hour; rainfall 0.74. Fruit trees broken, but no houses blown down.

*Clinton*—LUKE ROBERTS. July, 1891, was the coldest July since 1882, when temperature was the same. It was 3.7° below the mean of the last thirteen years. Rainfall, about normal, and in quantity just enough for agricultural purposes. Farmers had a glorious month for securing their grain. All crops have done well. Streams all low, the Mississippi being 1½ feet above low water mark. Maximum velocity of wind, 26 miles, on the 6th. Total movement of wind for month, 2,940 miles.

*College Springs*—A. A. BERRY. July has been a very cool month. Too much rain for harvesting. Corn about three weeks late. Fall wheat turning out well—twenty to thirty bushels per acre. Fruit promises enormous yield. Hay as heavy as ever known; pastures good.

*Stilson*—WM. WOOD. On the 22d lightning struck the stable of Peter Nelson and killed five horses. At same time lightning struck the large hay barn of John Ward, in Wesley, and killed four horses and some hogs. Both barns were consumed with hay, grain and machinery. During same storm Mr. Anderson, southeast of this place, had two horses killed in pasture by lightning. In Britt a house was struck. It was a terrible storm. East of here a house was struck and burned. The strange sight of three buildings burning at the same time in different directions was witnessed while the lightning and thunder were intense and continuous.

*Alla*—DAVID E. HADDEN. The month of July, 1881, was unusually cool, the mean monthly temperature being 6.7° colder, the mean noon temperature 6.5°, the maximum 12°, and the minimum temperature 11° colder than the corresponding date for the same month last year. The first decade was the coldest, and the second decade of the month the warmest, being 10.6° and 3.4° respectively, colder than the same periods in 1890.

Precipitation was greatly in excess, 3.26 inches more rain having fallen than in July last year. The total excess in precipitation since January 1, 1891, amounts to 11.14 inches. Twelve thunderstorms were noted on ten days, compared with seven on six days last year.

#### HAIL, WIND AND RAIN.

On the afternoon and evening of July 1st, a notable and destructive storm, or rather a series of storms, accompanied by hail, severe wind squalls, electric discharges and rain, swept diagonally across the western half of the State, from northwest to southeast, traversing a distance of nearly two hundred miles within a narrow belt extending from O'Brien to Decatur counties. This line formed the central pathway to the meteoric dis-



turbance, along which the destructive elements moved at different hours on the afternoon and evening of that date. A noteworthy feature of the disturbance was the fact that, while the squalls and hail came from the same general direction, the northwest, the effects of the storm occurred earliest in the afternoon within the southern half of the pathway of the storm above described. This indicates that there was a series of thunder-storms following the same general line, with the same accompaniments of destructive force. The maximum width and energy of the storm appear to have been reached in its passage through Adair county, wherein it was reported to be five to seven miles wide.

In Lincoln township, Audubon county, a small sized tornado was developed, which within a narrow pathway and short distance demolished a school house, two dwellings and a number of out-houses and barns. One person, Mrs. S. F. Garmire, was seriously injured.

A crop correspondent at Greenfield said: "On the afternoon of the first a destructive hail-storm five to seven miles in width passed diagonally across this country northwest to southeast, sweeping through the townships of Walnut, Jefferson, Grove, Harrison, corner of Greenfield, Grand River and Union, mainly along the course of the Grand river. The destruction of crops was very great along the line of the storm and numbers of horses were killed by being driven into wire fences."

Another reporter from the same county writes as follows: "The reports of the hail-storm in Adair county on the afternoon of July 1st, prove upon further examination to be no exaggeration. The storm entered Adair county near the town of Casey, and followed Middle river through Walnut, Jefferson, Harrison, Grove and Grand River townships with another branch of it coming down through Lincoln township. From Casey fourteen miles southeast and about four miles wide, about three-quarters of which was on the south side of Middle river. All crops were destroyed here. The storm coming through Lincoln township from the north joined the main body and the whole storm turned south for a short distance, leaving Middle river, and from this point through Grove, Harrison and Grand River townships destroyed everything in strips of six to seven miles wide. The hail was about the size of hulled walnuts, or one inch in diameter and down with some flat ones two inches long. There are places in Jefferson and Grove townships where small limbs and some of the bark is knocked off of the trees. There was a very strong wind. About one-sixth of the crops of Adair county are destroyed. The country through which the storm went is peopled with well-to-do farmers, and while it is a great loss, actual suffering will be limited."

Observers in Clarke and Decatur counties, located near the Grand river, give similar reports of great damage resulting from the great storm. The loss falls heavily on those whose crops were totally destroyed. It is probable that on the afternoon of that day the destruction of crops was well nigh complete within an area of over one hundred square miles, and two hundred thousand dollars would not fully compensate the farmers whose fields are desolated.

Observer H. B. Strever, of Larrabee, Cherokee county, writes: On the afternoon of July 1st, an electric storm formed about five or six miles west of Larrabee. It moved in a southeast direction between Larrabee and



Cherokee, thence southeast towards Missouri. Some damage was done to growing grain by hail at this place, and in the central line of storm some fields of grain were nearly ruined. On the afternoon of July 16th a hail-storm did serious damage to crops in Liberty township, about five miles north of Clighorn, and nine to ten west of Larrabee. Hail fell again during the heavy rain of the 21st and 22d, doing some damage to crops. The heavy rainfall washed fields, carried out bridges, culverts, grades, etc.

#### A SECOND FLOOD AT CHEROKEE.

The Cherokee *Times* of July 23d contained a graphic account of "Flood the Second," which visited that place on the night of July 21st, nearly a month after the first disastrous flood. Considerable damage resulted to buildings, crops and bridges. The rainfall at Larrabee, a few miles distant, was 3.94 inches. There was an accompaniment of hail and lightning.

A special to the *State Register* from Cherokee, dated July 22d, says: "Cherokee county has again been visited by a most disastrous rain and wind storm. It began yesterday evening, the rain, hail and high wind continuing until this morning. Railroad creek reached a height only two feet lower than the high water mark of last month, when it wrought such terrible havoc. Many residents on the flats became frightened and deserted their homes. Two houses which were removed from their foundations by the former flood were this morning carried into the Sioux river and dashed to pieces against Second street bridge. Many timbers and ruins of the late floods also washed against the bridge, which went out early this morning. Two other bridges in the city also went out this morning. There were washouts on the Illinois Central between here and Sioux City, and also on the Cherokee division. North and south of here the crops were materially damaged."

#### AUGUST.

**BAROMETER.** Mean pressure for the month 29.990 inches. Highest observed, 30.40 inches, at Omaha, on the 27th; lowest, 29.63 inches at Bancroft on the 29th. Range, 0.77 of inch.

**TEMPERATURE.** The mean temperature, 69.1°, was over 1° below the normal. The highest monthly mean was 75.4°, at Glenwood; lowest, 64.8° at Osage. The highest temperature reported was 106°, at Blakeville, on the 9th and at Glenwood on the 7th.

**PRECIPITATION.** Average for the State, 4.24 inches; greatest amount reported, 13.02, at Maxon; least amount reported, 1.23 inches, at Mason City. Greatest rainfall in any consecutive twenty-four hours 3.47 inches, at Amana, on the 10th and 11th. Average number of days on which .01 inch or more fell, 8.7.

**MISCELLANEOUS.** The prevailing direction of the wind was south. Highest velocity recorded, 42 miles an hour, at Davenport, on the 9th. Average number of cloudy days, 5.9; partly cloudy, 12.2; cloudless, 12.8.

Light frosts occurred on the 22d, 23d, 24th, 25th, 28th, 29th, 30th and 31st. Hail fell on the 11th at Sac City, 13th at Sanborn, Webster City, Larrabee, Richland, 18th at Corning, 29th at Blakeville and Independence. Thunderstorms occurred every day during the month except the 5th, 22d, 23d, 24th 27th, 30th and 31st.

## EXTRACTS FROM OBSERVERS' NOTES.

*Corning*—JEROME SMITH. A heavy wind and rain storm swept across the country in two belts about a mile wide on the evening of the 18th, doing a good deal of damage to corn and light buildings.

*Clinton*—LUKE ROBERTS, M. D. August, 1891, was about normal in temperature, being one-half a degree below. The first and second decades were warm but very humid. The third decade was cool and dry. The mean temperature for the first and second decades was 72.70, while for the month it was only 68.90. The mean August precipitation for the last 18 years was 3.00 inches; and for August, 1891, 3.89 inches. On the whole the month was favorable to growing crops, which had been held in check from a cold July. No frost in this locality. The movement of wind was light, being only 3,350 miles; averaging some days only one mile an hour.

*Ames*—J. C. HAINER. The close of the month was remarkable for the low temperatures recorded. On the 24th the minimum temperature recorded was 32.75°, and considerable frost was seen.

*Blakeville*—JAMES RODGERS. Had three light frosts on low ground, but no damage was done. The hail storm of the 29th caused some damage to corn four miles northeast of here. Hail stones, large as hickory nuts, fell. Lowest temperature at sunrise was 44°, on the 28d.

*Amana*—CONRAD SCHADT. During the night of the 10th the rainfall was 3.22 inches. Lightning struck three houses in this place during the night, two of which were set on fire, but the fire was extinguished without material loss. Other buildings were struck in adjoining towns. There were six cases in which lightning struck buildings, and two in which it struck animals on the same night, within the radius of three and one-half miles. No human lives were lost.

*Fontanelle*—C. W. KILBURN. The weather was very warm the first few days in August. On the 20th a cool wave came, which lasted to the 25th, with a light frost on the 24th. Threshing commenced August 8th, with yield of oats from 35 to 40 bushels per acre.

*Glenwood*—SETH DEAN. The storm of the 18th was terrific, a grand electric display. Frost of 23d and 24th on low ground did no damage. The corn crop is about three weeks late, but the prospect now is favorable for most of it to mature. Hay is good, and is being rapidly secured. The tomato is abundant, and ripening well. The apple crop is the largest ever grown in this county.

*Fayette*—R. Z. LATIMER. Of the four thunder storms during the month the one on the 29th was the most severe, some stock being killed by lightning. Four frosts during the month—on 22d, 23d, 24th and 28th, the heaviest being on 24th, with temperature dropping to 34°; slight damage. A fine display of aurora borealis was seen on night of the 29th.

*Storm Lake*—A. J. BOND. The mean of the month has been one degree warmer than August last year.

*Stilson*—WM. WARD. August meteors were somewhat more numerous than for 20 years. Fifty were counted from 8:30 to 9:00 o'clock. Nothing hurt by frost here.

*Marshalltown*—CHAS. R. BROWN. The entire month was too cool for corn. Small grain all did well. Wheat made from 30 to 35 bushels per acre.

*Logan*—MRS. M. B. STERN. A violent electric storm occurred on the 18th. Lightning struck in four different places; nobody hurt. There was a continued crash for half an hour. Frosts on 23d and 24th, but not much damage was done.

*Monticello*—H. D. SMITH. Maximum temperature for August since 1854, 100°, in 1887; minimum, 36°, in 1863; maximum mean, 77.1°, in 1861; minimum mean, 64.3°, in 1863; normal, 70.2°. The maximum precipitation was 8.50 inches, in 1885; minimum, 0.22, in 1880; normal, 4.00 inches.

*Larrabee*—H. B. STREVER. Severe thunder storms occurred during the month. Hail on the 13th, but no damage. Frost on the 23d and 24th did no damage.

#### A HEAVY WIND STORM.

On the afternoon of Sunday, August 9th, a heavy wind or rain storm, originating in Ringgold or Decatur county, swept through the S. C. and S. E. districts to the Mississippi river and beyond, the general direction being a little north of east. The width of the belt of disturbance at its inception was fifteen to twenty miles, and it was fully fifty miles wide when it reached the river. It was a wind-squall of unprecedented force (not a tornado or "cyclone," as reported), and the damage to growing crops, stacks and shocks of grain and hay, buildings and fruit, were very heavy in the aggregate, though the first reports were probably exaggerated.

The following from the *Fairfield Ledger* gives an idea of the force of the storm in Jefferson county:

"Mercury ranged from 90 to 99 degrees in the shade, Saturday, the hottest weather of the summer. A brisk breeze was blowing most of the time, however, and that served to temper the heat. Sunday afternoon dark clouds gathered in the southwest; the wind swelled to a perfect gale and rain fell in torrents. In the city trees were crushed and broken, light buildings were roughly shaken up and bill boards, awnings and similar structures were completely wrecked. The tin roof on the Light building near the northeast corner of the square, was partially torn off, and the front of W. E. Thompson's implement warehouse near the C., B. & Q. station was blown down. The weather vane on the electric light tower appears to be a foot or two out of plumb and the top section of the structure is badly twisted. Some people say that this is the result of the electric storm of a week ago. During the two hours that the storm raged, from 3 to 5 o'clock, the rainfall was 1.76 inches.

"The storm crossed the county from southwest to northeast, and from what we can learn was about as severe at Fairfield as any place. The roof of a tenement house on the county farm was blown off, and W. G. Burkhart in Locust Grove township, suffered by the unroofing of his barn. Fences and light buildings were demolished in many places. Fruit and other trees were roughly treated and in some localities nearly all the apples are said to be on the ground. Grain and hay in shock and stack were considerably damaged everywhere, unless extra good care had been taken with them. Corn was blown and twisted at every place in the path of the storm, but it is probable that the rain did it more good than the wind did harm."

## DAMAGE BY HAIL.

On the 18th two hail storms passed through the northeastern part of O'Brien and a portion of Osceola, causing heavy damage within a belt three or four miles wide. Hail stones three inches in diameter were picked up. One reporter estimates the damage in the two counties at a half million dollars. This is probably an over estimate.

## RAINFALL IN JEFFERSON COUNTY.

*Editor's Ledger*—From August 9th to 19th, or eleven days, we have had 7.57 inches of rain. This, for Jefferson county, is excessive, and comes at a time to do much injury. I can find from the records at hand no rains that equal this. Our heavy rains in the past sixteen years have been: September, 1876, in five days, 9 inches; 4.50 inches of this fell in eight hours. This is the heaviest single rain the county has had, so far as I know. April 20, 1878, 4.60 inches fell in the twenty-four hours. October 7 and 8, 1884, 4.47 inches fell, and July 23 and 24, 1885, 3.86 inches are recorded. In May, 1888, in five days, 5.64 inches fell. June 7 and 8, 1889, we had 3.58 inches.

The accompanying table gives the rainfall for sixteen years. It will be seen that the average for our county for the year is 32.64 inches. The greatest fall is in June; next comes May, and then August, September and October form a second maximum in the curve. In the winter months the precipitation is slight. The figures here represent melted snow.

## YEA

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## Average....

There was in 1890 less rain than in any past year on record, and in 1886 very little fell. Thus far in 1891 I have recorded nearly six inches more than the average.

DR. J. FRED CLARKE.

## SEPTEMBER

**BAROMETER.** Mean pressure for the month, 30.074 inches; highest observed, 30.39 inches, on the 9th, at Davenport; lowest observed, 29.65 inches, on the 14th, at Bancroft; range for the State, 0.74.

**TEMPERATURE.** The month of September was remarkable for its high temperature, its large percentage of clear weather, and the absence of

heavy storms usually incident to the beginning of the autumnal season. September appears to have swapped places with August, and it was throughout a summer month. The last half of the month was warmer than any corresponding period on record in this State. It is not uncommon in this latitude to have warm weather up to the middle of September, but it is quite unprecedented to have such tropical heat in the last decade of the month. The tables will show some very notable records of temperature in all parts of the State. It was timely and providential, saving the corn crop from impending danger, and crowning a season of unparalleled productiveness. The highest monthly mean was  $73.9^{\circ}$ , at Bonaparte and Fort Madison; lowest,  $61.4^{\circ}$ , at Osage. The highest temperature reported was  $104^{\circ}$ , at Glenwood on the 22d, and the lowest  $28^{\circ}$  at Greenville on the 6th.

**PRECIPITATION.** The average for the State, 1.33, inches was much below the normal for this month. The greatest amount reported was 3.60 inches, at Eagle Grove, and the least amount, 0.13, at Hopeville.

**MISCELLANEOUS.** The prevailing direction of the wind was south. The highest velocity recorded was 50 miles an hour, at Sioux City, on the 30th. Average number of cloudy days, 2.7; partly cloudy, 7.3; cloudless, 20.0. Thunder storms occurred on the 1, 2, 5, 7, 11, 12, 15, 17, 18, 19, 20, 24, 26, 27, 28, 29. Frosts occurred on the 2, 3, 4, 5, 8, 28, 29, 30; all light.

#### EXTRACTS FROM OBSERVERS' NOTES.

*Tipton*—J. M. RIDER. On Saturday, September 26th at 11 o'clock P. M., a number of persons distinctly felt a shaking and rumbling, described as sounding like cars. Three distinct waves were felt.

*Sac City*—DR. CALEB BROWN. Thunder on evening of the 11th. Light frost on the 28th and 29th.

*Panama*—WM. J. WICKS. On the 11th it rained 1.60 inches in forty-five minutes. On the 29th there was a heavy frost, the first severe one of the season.

*Oskaloosa*—JOS. BOYD. The month has been dry and warm and very favorable for all growing crops.

*Logan*—MRS. M. B. STERN. The mercury fell to  $35^{\circ}$  on the morning of the 29th, killing tender vines in low places. The month was quite warm; some high winds, but no hurricanes.

*Independence*—E. F. WULFKE. From the 15th to the 23d every day the temperature was  $92^{\circ}$  to  $98^{\circ}$  in the sun. Foggy days, 7th, 8th and 9th, on low ground.

*Hopeville*—M. T. ASHLEY. A splendid month for ripening off and maturing the corn. Too dry for pastures and meadows. Fall plowing and seeding delayed by drought. Stock generally doing well.

*Blakeville*—JAS. RODGERS. Remarkably dry and hot with but six cloudy days during the month. Excellent for ripening corn, which is a good average crop. All kinds of fruit and vegetables in abundance, the best I have ever known. The people of Iowa are bountifully provided for and have good reason to be thankful.

*Amana*—CONRAD SCHADT. On the 23d at about 8:20 P. M., a meteor was observed at the zenith moving northwest, leaving a long and brilliant trail in its track. The cosmic traveler was seen by but few, but its brilliancy was such that many, even in lighted rooms, noticed the flash of light. As it

disappeared at about the altitude of the Polar star, and gave no sound, it probably passed swiftly and noiselessly into celestial space again, pursuing its lonely path. The earthquake at about 11 P. M. on the 26th was noticed by a number of people. At close of the month, the river was lower than it was for years.

*Cedar Rapids*—H. D. OLDS. The water in the river at the close of the month was the lowest it has been during the season. No killing frost, and the crops have all matured and the yield is bountiful. An earthquake shock of considerable violence was experienced at this station on evening of the 26th, between 22:50 and 22:55 o'clock (10:50–5 P. M.). Its duration is variously estimated at from one to three minutes, but it was probably under fifty seconds. The vibrations were sufficient to cause windows and doors to rattle, and wake persons from a sound sleep. It was generally noticed in surrounding towns.

*Clinton*—LUKE ROBERTS. The characteristics of the month were an excess of sunshine, the number of clear days, high temperature and minimum of rainfall. From the 16th to 27th inclusive (nine days) the temperature reached 90° or above. The weather was propitious for the corn crop, which with an early frost would have been damaged 50 per cent. As it is, the crop is wonderful. The Mississippi reached low water mark.

*Cresco*—GREGORY MARSHALL. No killing frosts occurred this month, consequently the corn, which otherwise would have been a failure, has by the hot spell at the end of the month been converted into a very acceptable average crop. The year of plenty is complete. *Laus Deo.*

*Fort Madison*—MISS L. A. MCCREADY. There was a shock of an earthquake here on the 26th, at 10:50 P. M. It was 11 seconds in duration and was perceptibly felt by large numbers. The month was very dry and warm. The Mississippi is quite low.

*Monticello*—HENRY D. SMITH. Light frost on 29th, but no damage resulted. The maximum temperature for September since 1854 was 98°, in 1854; minimum, 26°, in 1871 and 1888. The highest mean temperature was 73°, in 1865; lowest, 51°, in 1871; normal for the month, 61.48. September, 1891, was 4° above normal. The maximum rainfall since 1854 was 10.75 inches in September, 1881; minimum, 0.00 in 1871; normal for the month, 4.07 inches. In the years 1854, 1858, 1860, 1865, 1870, 1884, the month was warmer than this year, but 1871 was the only year with less rainfall. Probably in no other September was the latter half of the month so warm since 1865. The number of clear days was, 25; fair, 5; and cloudy, 0—a thing very unusual for September.

#### OCTOBER.

**BAROMETER.** Mean pressure for the month, 30.115 inches; highest observed, 30.65 inches, on the 27th, at Bancroft and Clarinda; lowest observed, 29.73 inches, on the 1st, at Sioux City; range for the State, .92 inch.

**TEMPERATURE.** Monthly mean, 50.0°; highest monthly mean, 56.4°, at Glenwood; lowest monthly, 43.9°, at Williams; the highest temperature reported was 92°, on the 1st and 2d, at Bonaparte, and on the 2d at Moor; the lowest was 19°, on the 22d, at Atlantic and Fayette.

**PRECIPITATION.** Average for the State, 2.77 inches; greatest amount reported, 6.53 inches, at Panama; least amount reported, .85 inch, at McCaus-



land; greatest amount reported in any twenty-four consecutive hours, 4.22 inches, on the 3d, at Panama; average number of days on which .01 inch or more fell, 5.7.

**MISCELLANEOUS.** The prevailing direction of the wind was northwest. Highest velocity reported, 46 miles an hour, at Sioux City, on the 2d. The average number of cloudy days was 6.5; partly cloudy, 6.8; cloudless, 17.6. The first snow was reported on the 6th at a number of places.

#### EXTRACTS FROM OBSERVERS' NOTES.

*Amana*—CONRAD SCHADT. October 22d the first killing frost occurred. Up to this date all trees, with few exceptions, looked bright and green; but after the frost they turned color and dropped leaves rapidly.

*Blockton*—C. W. THOMPSON. First frost on the 5th. On the night of the 31st ice one-eighth of an inch thick was formed. No winds or severe storms. Ground has not been frozen during October.

*Bonaparte*—B. R. VALE. It rained severely all day on the 6th inst. till about 4 P. M., when it turned to snow, continuing about an hour, making things white where not too wet. This is the earliest snow I remember, and I have lived here since 1850.

*Carroll*—MOSES SIMON. Plenty of sunshine and fine weather gave plenty of time for fall plowing and husking corn. Nineteen days without a trace of rain.

*Clinton*—LUKE ROBERTS, M. D. The temperature was normal; the maximum 6.70° in excess of ten years normal, and minimum 5° below. Rainfall 1.34 below the 13 year mean. The wind moved 3,820 miles during the month, which was 1,164 miles below a mean of the last ten years. First frost of the season was seen on the 5th inst. First killing frost on the 16th. The month was very fine for bodily comfort and labor. Too dry for plowing and for pasturage. Streams were very low. The Mississippi remained near the low water mark all the month and navigation was much impeded.

*College Springs*—A. A. BERRY. A very favorable month. The rains coming at the first of the month were timely for putting in fall wheat and starting pastures. A great deal of wheat was sown—double the amount ever before.

*Cedar Rapids*—H. D. OLDS. The first frost to injure vegetation was had on the 16th, the fog on the morning of the 5th preventing any injury to even the tenderest plants.

#### NOVEMBER.

**BAROMETER.** Mean pressure for the month, 30.112; highest observed, 30.78 inches, at Bancroft; lowest observed, 29.50 inches, on the 27th, at Keokuk; range for the State, 1.28 inch.

**TEMPERATURE.** The average daily temperature of the month of November was about six degrees below the normal throughout the State. The first half of the month was somewhat warmer than the seasonal average. During the last half wintry weather prevailed. The records of the Central Station show that the daily average temperature of the last half of November was 12.8° lower than during the first half of December. On the 28, the minimum of 7° below zero was recorded, and on the 28th, 24° below.

The monthly mean was  $30.5^{\circ}$ ; highest monthly mean  $37^{\circ}$ , at Fort Madison; lowest,  $23.5^{\circ}$ , at Williams. The highest temperature reported was  $84^{\circ}$ , on the 6th, at Glenwood, and the lowest was  $24^{\circ}$ , at Larrabee and Sanborn, on the 28th.

**PRECIPITATION.** Average for the State, 1.70 inches; greatest amount reported, 3.64 inches; least amount reported, .06 inch, at Glenwood; average number of days on which .01 inch or more fell, 6.6.

**MISCELLANEOUS.** The prevailing wind direction was northwest. Highest velocity recorded, 41 miles an hour, at Sioux City, on the 18th. Average number of cloudy days, 12.3; partly cloudy, 8.3; cloudless, 9.4. Thunder storms occurred on the 7th, 15th, 9th, 21st, 11th.

#### EXTRACTS FROM OBSERVERS' NOTES.

*Belle Plaine*—H. W. VAN DIKE. A brilliant electrical display was observed at 1:20 A. M. of the 7th, accompanied by heavy thunder, a dash of hail and hard shower of short duration. Loud thunder was heard at intervals during the forenoon. At 2 P. M. the barometer marked 29.60 (reduced) with only light breezes from the east.

*Blockton*—C. W. THOMPSON. A slight thunder storm on the 7th; sunrise and sunset mostly clear, and beautifully red. Ground frozen 4 inches on the 29th. Birds of migration have disappeared.

*Williams*—M. L. FULLER. A meteor, resembling a ball of fire two inches in diameter, was seen just before sunrise on the 5th, its path being from altitude  $22^{\circ}$  N. N. E. to  $12^{\circ}$  due N. Heaviest rain occurred on morning of 15th.

*Cedar Rapids*—H. D. OLDS. The thunder shower of the 7th was one of the most severe experienced during the past season. Lightning struck in several places in this city, and one house was nearly destroyed by fire caused by lightning; no person injured. About usual stage of water. The month was colder than any November in six years past.

*Clinton*—LUKE ROBERTS. November, 1891, was the coldest in thirteen years, except November, 1880, which was  $3.7^{\circ}$  lower. The mean temperature of the last thirteen years was  $34^{\circ}$ , and the last November was  $31.2^{\circ}$ . The maximum was  $57^{\circ}$ , or  $6^{\circ}$  below a mean for the last ten years. The minimum was  $23.3^{\circ}$  below mean of the last ten years. Only once before in the last ten years did the minimum for November go below zero, and this was in 1887. The rainfall was above normal. Only twice has it been exceeded in the last thirteen Novembers, viz: in 1883 and 1888. Cloudiness above normal, and number of clear days below. Total movement of wind, 4,865 miles—700 miles in excess of normal. First snow came on the 14th; on the 15th we had 1.38 inches of rainfall, the heaviest in one storm since the 11th of August. On the 7th was the first rain after October 17th.

*Blakeville*—JAMES RODGERS. There were fourteen days of sunshine during November; six foggy days and more or less rain or snow. Wind mostly N. N. W.

*Larrabee*—H. B. STREVER. Rain and snow on morning of the 15th; sleighing a few days. Last plowing in this vicinity was done on the 15th. Ground was frozen 7 inches in unprotected places, at close of month.

*Monticello*—H. D. SMITH. Maximum temperature in November since 1854 was  $70^{\circ}$ , in 1887 and 1888; minimum,  $19^{\circ}$  below zero, in 1887. The high-



est mean was  $41.5^{\circ}$ , in 1859, and the lowest was  $25^{\circ}$ , in 1858; normal for November,  $33.36^{\circ}$ .

The normal precipitation for the month is 3.32. Maximum since 1854 was 5.29 inches, in 1879; minimum, 0.12 in 1865. Maximum snowfall, 16 inches in 1869; normal, 3.32; 1887 was the only year we had colder weather in November. The coldest in the winter of 1890 and '91 was  $15^{\circ}$ , in February.

*Fayette*—R. Z. LATIMER. We had one thunder storm during the month, on the 7th. The first snow fell on 14th. Ground frozen on 15th and there was good skating on the 16th.

*Amana*—CONRAD SCHADT. On the 7th thunder storms occurred at 1:00 A. M., 3:00 A. M., 8:00 P. M., 7:00 P. M., and in the night. Two head of cattle were killed by lightning. First snow on the 11th.

#### DECEMBER.

**BAROMETER.** Mean pressure for the month, 30.018 inches; highest observed, 30.749 inches, on the 11th, at Cresco; lowest observed, 29.142 inches, on the 3d, at Dubuque; range for the State, 1.607 inches.

**TEMPERATURE.** The average daily temperature for the month of December was about  $7.5^{\circ}$  above normal. There have been but two milder Decembers within the past twenty years, viz, in 1889 and 1877. Monthly mean,  $32.3^{\circ}$ ; highest monthly mean,  $39^{\circ}$ , at Fort Madison; lowest monthly mean,  $26^{\circ}$ , at Williams; the highest temperature reported was,  $72^{\circ}$ , on the 31st, at Glenwood; the lowest was  $14^{\circ}$ , on the 26th, at Larrabee.

**PRECIPITATION.** Average for the State, 2.41 inches; greatest amount, 4.50 inches, at Blakeville; least amount reported, 1.21 inches, at Glenwood; average amount of snow fall, 5.1 inches; average number of days on which .01 inch or more fell, 6.5.

**MISCELLANEOUS.** Prevailing direction of the wind, south. Highest velocity reported, 42 miles an hour, on the 4th, at Davenport, and on the same date at Sioux City. The average number of cloudy days was 7.9; partly cloudy, 9.4; cloudless, 13.6.

Thunder storms occurred at various points on the 1st, 2d, 3d, 14th, 21st, 22d, 25th and 31st.

#### EXTRACTS FROM OBSERVERS' NOTES.

*Corning*—JOHN W. BIXBY. On the night of December 21st we had a very heavy storm, accompanied by lightning and thunder and hail. Also on the 31st there were storms with lightning and thunder, which is a new kind of weather for this part of the country during the winter season.

*Williams*—M. L. FULLER. An active thunder storm, accompanied by hail, sleet and wind, occurred on the evening of the 21st. Also on the 31st the rain storm was accompanied by lightning a few miles southeast.

*Logan*—MRS. M. B. STERN. On the 3d and 21st we had thunder storms. On the latter date there was a bright rainbow.

*College Springs*—A. A. BERRY. December was a very good month, with considerable mild weather. On the 21st there was a very heavy electric storm, with light wind and hail. On the evening of the 31st a heavy rain with lightning and thunder visited this section.

*Monticello*—HENRY D. SMITH. The maximum temperature for December since 1854, was  $65^{\circ}$ , in 1889; minimum,  $-36^{\circ}$ , in 1862; the normal for the

month is  $21.45^{\circ}$ . In 1877 the mean was  $39.50^{\circ}$ , and in 1859 it was  $8.1^{\circ}$ ; maximum precipitation, 6.99 inches, in 1856; minimum, 0.65 inches, in 1867. The past month was warmer than November, and nearly  $10^{\circ}$  above normal. The year 1891 was a little above normal in temperature, being  $47.02^{\circ}$ ; normal,  $46.18^{\circ}$ . The normal annual precipitation for this station is 36.65 inches; in 1891 it was 27.22 inches.

*Blakeville*—JAS. RODGERS. We had thunder and lightning on the 21st with some hail. There was one inch of snow on the 4th and  $1\frac{1}{4}$  inches on the 25th.

*Bonaparte*—B. R. VALE. A month of exceedingly bad roads, impassable in some instances, rendering fields in bad shape, and making it difficult to complete corn gathering. However, it is about all gathered now. The moisture will be good for the soil and for future results.

*Cedar Rapids*—H. D. OLDS. The mean temperature for December has been but little lower than for November, and the total snowfall at this station was but two inches. Water in streams and wells is getting low. There has been ice on the river the most of the month. There have been some very sudden changes in pressure. The change of the 10th to 12th, showing very steep gradients and reaching the highest barometer reading recorded in six years, being 30.720 inches.

*Carroll*—M. SIMON. The weather during the month was mild. A heavy rain and thunder storm passed over the county on the 21st, followed by a cold wave, which must have been injurious to winter wheat. Roads during the latter part of the month were in very bad condition.

*Marshalltown*—CHAS. R. BROWN. On Monday afternoon, December 21, a drizzling rain set in with a south wind. It ceased at 5 P. M., but the weather remained warm. A thunder cloud appeared in the west at 8 P. M. It soon began raining with vivid lightning and hail the size of peas followed. Soon after the storm struck the west end of the city a tornado (or heavy squall) scarcely one hundred feet wide, cut its way like a knife through two or three blocks of residences and demolished one small house and four or five barns, besides seriously injuring several other buildings. Trees in its track were snapped off or uprooted. It would tear off part of a house and leave the chimneys standing on the other part. The rain and hail made 0.44 inches of water.

*Larrabee*—H. B. STREVER. December has been remarkably mild. Two thunder storms occurred during the month, the first between 2 and 3 A. M. on the 3d, the movement being from S. S. E. to W. N. W.; the second between 5:15 and 6 P. M. on the 22nd, passing S. W. to N. E. Considerable hail fell during the latter shower, with high N. W. winds, and temperature at  $32^{\circ}$ , the storm continuing till about 4 P. M. During the afternoon while the storm was in progress the high wind rolled the light, moist snow up into snowballs. Scores of these were seen, the greater number being 6 to 10 inches in diameter, while occasionally one formed as large in diameter as an ordinary barrel. Large, level fields sloping gently to southeast furnished favorable ground for their formation. Ground was frozen 5 to 7 inches in fall plowed fields at close of the month.

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**THE CROP SEASON OF 1891.**

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The most interesting and important records of this Bureau are those which relate to the crop season, beginning about the 1st of April and closing the 1st of October. And as the year 1891 was one of phenomenal productiveness the summaries of the monthly crop reviews and weekly bulletins are copied in this report, as giving a complete and consecutive record of the agricultural season, from seed time to harvest. It will be noted that there were many apparent drawbacks, and at times the crop outlook was anything but promising; but the outcome far exceeded expectations, bringing abundant rewards for the labors of the diligent husbandman.

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**JUNE CROP REPORT.**

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**SHOWING THE ESTIMATED ACREAGE AND AVERAGE CONDITION OF THE STAPLE CROPS.**

The crop season of 1891 was generally late, and the weather conditions were unfavorable for seeding and other farm work during March and the first half of April. The last half of April brought more favorable conditions for planting, and gave a strong impetus to vegetation. May was cool and dry until near the close of the month, and in many parts of the State grass and small grain suffered materially from drought and cold weather. But despite all these drawbacks and adverse conditions, our June crop report makes a very good showing for the State at large, giving a new illustration of the never failing productiveness of Iowa.

Compared with last year, there is an increase in the acreage of winter wheat, corn, broom corn, winter and spring rye, winter and spring barley, oats, flax, clover, millet, Irish and sweet potatoes; and a decrease in spring wheat, sorghum and timothy. And the average condition of corn, wheat, rye, barley, clover, potatoes, and all kinds of fruit, is materially better than last year.

**WINTER WHEAT.** The reports indicate an increase of 12½ per cent in the acreage of this cereal, and that it has been planted in 72 counties, as against 66 last year. The condition of the crop as reported by 440 correspondents, is 104 per cent. The crop was damaged to some extent in Louisa and Des Moines counties by the Hessian fly, and the growth of straw is so great in some sections as to seriously endanger the crop. The tables will show its condition by counties.

**SPRING WHEAT.** Of this cereal 364 correspondents report an increase in the acreage, and 326 a decrease; showing an average decrease of 1 per cent.

Its condition, as reported by 774 correspondents, is  $94\frac{1}{2}$  per cent, against  $93\frac{1}{2}$  last year. The total acreage is 2,071,968—a decrease of 20,928 acres. The remarks and estimates of correspondents will show to what extent it is injured by insects or other adverse conditions in the several counties.

**CORN.** There has been an increase of  $8\frac{1}{2}$  per cent in the area planted to this great staple, as reported by 926 observers. Of this number 93 report a small decrease, and 833 an increase. This adds 748,984 to the number of acres planted, as compared with last year, making a total acreage of 9,808,811. The condition of the crop, as shown by 1,025 correspondents, is 95 per cent, as against  $89\frac{1}{2}$  per cent June 1st, 1890. From every county we have reports of the depredations of the cut and wire worms, but the full extent of damage can not at this time be estimated. More than the usual amount of replanting has been necessitated by the destructive work of these pests.

**BROOM CORN.** This crop is not extensively grown in Iowa; and 52 correspondents note an increase, and 31 a decrease, giving an average increase of 2 per cent. Its condition is  $91\frac{1}{2}$  per cent. The total acreage this year is 2,320.

**SORGHUM.** Increase reported by 246 correspondents, while 242 report a decrease in this crop, giving an average decrease of  $2\frac{1}{2}$  per cent. This would reduce the total number of acres to 21,030. The average condition is 94 per cent.

**WINTER RYE.** Of this crop 408 correspondents note an increase, and 233 a decrease; and the average increase is computed to be  $2\frac{1}{2}$  per cent. Its condition is 99 per cent.

**SPRING RYE.** There appears to have been an increase of  $1\frac{1}{2}$  per cent in the acreage of this crop, 50 reporting an increase and 26 a decrease. Its condition is placed at  $95\frac{1}{2}$  per cent.

**WINTER BARLEY.** The small acreage of this crop has been increased  $2\frac{1}{2}$  per cent; 9 reports giving an increase, and 8 a decrease. It is rated at  $94\frac{1}{2}$  per cent in condition.

**SPRING BARLEY.** Two hundred and seventy-two observers note an increase and 156 a decrease, giving an increase of  $2\frac{1}{2}$  per cent in its acreage. Condition of crop by 487 observers,  $92\frac{1}{2}$  per cent. Total present acreage, 156,161.

**OATS.** There is an estimated increase of  $3\frac{1}{2}$  per cent in the area of this staple crop; 629 observers noting an increase, and 281 a decrease. Its condition is rated  $92\frac{1}{2}$  per cent. Compared with the acreage of 1890, there is an increase of 96,555, making the total number of acres 2,895,270. It was badly injured by drought in the northern half of the State, and there is an excessive growth of straw in the southern districts.

**FLAX.** There appears to have been an increase of  $4\frac{1}{2}$  per cent in the area of this crop; 293 reporting an increase, and 160 a decrease. The average condition is 91 per cent; and the present total number of acres is estimated to be 295,689.

**TIMOTHY.** There appears to have been a decrease of about  $\frac{1}{2}$  of 1 per cent in the acreage of this crop, as shown by the reports of 867 correspondents. Its condition is 88 per cent. The total present area is estimated to be 3,349,734 acres. Timothy has been badly injured by worms, and checked by drought at the stage when it most needed moisture.

**CLOVER.** According to 586 observers there has been an increase, and 229

report a decrease, making an average of 5 per cent. Its condition is reported to be 93½ per cent.

**MILLET.** The increase in this most useful forage crop is estimated to be 10 per cent, and its condition is placed at 94½ per cent by 404 observers.

**IRISH POTATOES.** Six hundred and forty-nine correspondents report an increase, and 191 a decrease, making an average increase of 6½ per cent. This would make the present area 180,425 acres. Condition, 97½ per cent by 969 correspondents.

**SWEET POTATOES.** There has been an increase of 5 per cent in the area of this crop as compared with last year, and its condition is 95 per cent, according to 426 observers.

**FRUIT.** The condition of fruit is rated much higher than in June, 1890. Apples are rated by 984 reporters at 101 per cent; peaches, 106 per cent by 198 correspondents; pears, 99 per cent, by 197 reporters; plums, 96 per cent, by 908 reporters; grapes, 98½ per cent, by 911 reporters; currants, 985 reports, 100 per cent; raspberries, 944 reports, 96 per cent; strawberries, 981 reports, 94½ per cent; blackberries, 862 reports, 98½ per cent; gooseberries, 918 reports, 97 per cent.

**STOCK.** In the remarks by correspondents as summarized it will be seen that the general condition of live stock is fair; the exceptional cases are noted. Cattle, 999 reports, 98½ per cent; hogs, 996 reports, 92½ per cent; sheep, 824 reports, 99½ per cent; horses, 999 reports, 96½ per cent. There appears to have been considerable loss of pigs and colts, caused in part by scarcity of feed, and thin condition of sows and mares.

May 29th was the date of the latest frost, but no material damage resulted from any frost after the middle of May. Considering the frequency of frost visitations the total damage resulting therefrom was very light.

The condition of soil is placed at 98 per cent as the average of 987 reports.

Three hundred and seventy-eight correspondents estimate the season to have been ten days early; and 463 make it ten days late in their respective localities. It was doubtless both early and late as to certain things noted. The flowering of certain trees and the growth of grass would be marked early; but the season favorable to seeding of small grain was ten days or more late. The corn planting season was about as early as the average; possibly in some sections a little earlier.

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## JULY CROP REPORT.

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### AVERAGE CONDITION OF THE CROPS.

The reports for this month, tabulated from the estimates of about one thousand practical farmers and experienced observers, show that despite all the drawbacks of the May drought, June floods, severe local storms, insect pests and fungus diseases, the great staple crops have made seasonable growth and have advanced several points in relative condition. As compared with 1890, the improvement is marked and encouraging.

The following staple crops show an increase in condition over the June report: Spring wheat, rye, barley, oats, flax, timothy, clover, millet, Irish and sweet potatoes, pasturage, grapes and raspberries.

**WINTER WHEAT.** This cereal has more than justified the expectations of the farmers who have this year given it a trial, and with favorable weather for harvesting and threshing the average yield will be good. The average condition is marked 103½; last month 104.

**SPRING WHEAT.** The estimates of 784 correspondents show a slight improvement in the condition of this crop, rating it 97½ per cent as against 94½ last month.

**CORN.** This crop has to contend against surplus moisture in many localities, and cool periods, which gave the weeds an advantage in the race; but the reports show that corn is coming out ahead and will make a fair crop with favoring conditions in the future. Its condition is 95 per cent—the same relatively as last month. The acreage has been decreased within the month by local floods, hail storms and cut worms, to the extent, probably, of three per cent of the amount reported June 1st. This estimate will leave the total acreage 9,029,000.

**BROOM CORN.** About same as last month; small amount grown.

**SORGHUM CANE.** The low price of sugar has caused a decline in the acreage of this crop; condition July 1st, 92½ per cent.

**WINTER RYE.** This has proved to be a profitable crop within the limited area where it is grown, and its condition is rated at 100½.

**SPRING RYE.** Comparatively little grown; condition, 95½ per cent.

**WINTER BARLEY.** Small acreage; condition, 96.

**SPRING BARLEY.** This crop has done well generally, and is marked 100½ by 454 correspondents; last month, 92½.

**OATS.** Nine hundred and forty-eight correspondents rate this crop 99½; condition last month, 92½. Its greatest drawback is too rank growth of straw, causing it to lodge in many localities.

**FLAX.** There has been a notable improvement in the condition of this crop, its condition being marked 97 per cent, as against 91 last month.

**TIMOTHY.** This crop has been advanced several points by the copious rains of June, the average being placed at 92½; last month, 88.

**CLOVER.** This staple forage crop has little more than held its own, being rated 96½; last month 98½. Most of it has been cut.

**MILLET.** Advanced from 94½ to 99½. The acreage has been considerably increased since June 1st on account of the failure of other crops.

**IRISH POTATOES.** Eight hundred and forty-six correspondents estimate the condition of this crop 118 per cent, as against 97½ last month. The wet weather has favored the crop, and the beetles have not yet been damaging.

**SWEET POTATOES.** Average condition, 96½; last month, 95.

**PASTURAGE.** This great support of Iowa's vast herds has advanced within the month to 105½ per cent; nearly every township reporting an improvement.

**FRUIT.** Apples have fallen from 101 to 95½ per cent. Peaches are rated 105; plums, 98½; cherries, 105; grapes, 99½; raspberries, 99½; blackberries, 98½; currants, 101.

Reports show that stock is generally healthy and thriving on the abundant pasturage of the State.



## AUGUST CROP REPORT.

## ESTIMATED CONDITION AND AVERAGE YIELD OF THE CROPS.

The daily average temperature throughout the month of July was about six degrees below the normal, making it the coolest July within the past twenty years. This made it pleasanter for man and beast and favorable for work in the harvest fields, but the growth of corn was seriously checked, and the condition of that great staple crop has been set back a few points since the last report.

Despite frequent showers, an unusual degree of cloudiness and occasional heavy local downpours, great progress has been made in securing the hay and ripened grain crops, and the yield has been exceptionally heavy in nearly all portions of the State. Threshing operations have begun, and the returns are very encouraging. And even if the corn crop should be cut short by early frost, the aggregate value of the output of Iowa farms will be fully up to the average of recent years. Comparison with the report made August 1, 1890, shows a very heavy gain in all crops.

**CORN.** The condition of this crop, as shown by nine hundred and fifty-four correspondents, is  $89\frac{1}{2}$  per cent, a decrease of  $5\frac{1}{2}$  per cent since the first of July. The following counties report its condition above 100, viz.: Appanoose, 102; Davis, 119; Henry, 106; Jefferson, 103; Kossuth, 110; Keokuk, 105; Louisa, 102; Lucas, 109; Marion, 104; Van Buren, 106; Wapello, 103, and Washington, 105. Mahaska and Lee report 99 per cent. The lowest rating is 71 per cent, in Cherokee county, from the effects of heavy floods. Last year the condition of this crop for the State, at the corresponding date, was  $79\frac{1}{2}$  per cent, and the full returns of the year showed that even that low rating was too high. This year corn is in a healthy condition as to color and stand, and its only hazard is the danger of frost before reaching its full maturity. It needs highly favorable conditions till September to make a fair crop.

**BROOM CORN.** By 126 correspondents this crop is 92 per cent.

**SORGHUM.** Six hundred and five correspondents place the average at  $91\frac{1}{2}$  per cent, a decline of one point within the month.

**FLAX.** The condition of this crop has advanced within the month from 97 to  $99\frac{1}{2}$ , as reported by 469 correspondents.

**BUCKWHEAT.** Reported by 547 correspondents, 95 per cent.

**MILLET.** Advanced from  $99\frac{1}{2}$  to  $100\frac{1}{2}$ , as reported by 641 observers.

**MEADOWS.** Nine hundred and forty correspondents report meadows  $101\frac{1}{2}$  per cent.

**PASTURES.** Nine hundred and forty-six reports place pastures at  $103\frac{1}{2}$ .

**IRISH POTATOES.** Nine hundred and forty-nine correspondents give potatoes a flattering showing, placing the average at  $110\frac{1}{2}$  per cent.

**SWEET POTATOES.** This crop is rated at 98 per cent by 496 observers.

**APPLES.** The condition of this staple fruit is variable, ranging from 55 to 129 per cent, the average of 906 reports being 92½ per cent.

**GRAPES.** Reported by 864 correspondents, 101 per cent.

Estimated average yield per acre of crops harvested and threshed:

Winter wheat.....	20½ bushels.
Spring wheat.....	14½ bushels.
Winter barley.....	25 bushels.
Spring barley.....	28½ bushels.
Winter rye.....	20 bushels.
Spring rye.....	18½ bushels.
Oats.....	39½ bushels.
Hay.....	1½ tons.

## OCTOBER CROP REPORT.

### CONDITION AND AVERAGE YIELD OF THE CROPS.

The phenomenally warm and dry weather prevalent during nearly the entire month of September, ripened the corn and gave assurance of a yield greatly exceeding the most sanguine estimates made a month earlier. The average condition of the crop is marked 98½ per cent. By reference to the table it will be seen that its condition is quite variable, one county giving it a rating of 113 per cent, and another making it as low as 58 per cent. The reports from thirty-one counties estimate the crop at 100 per cent and over; twenty counties place it below 90 per cent. So it is safe to say that in about four-fifths of the State a full average crop has been secured. Several local storms, or very wet and cool weather at the critical stage of its growth, caused the shortage in the counties which report their condition below the average.

Though no actual tests of the yield had been made, our correspondents have given their estimates of the yield of corn per acre, and the averages of their markings will be found in the table. The average for the State is found to be 37½ bushels per acre. This is certainly a conservative estimate, and we believe that in three-fourths of the State the final results of the husking will show an average of over 40 bushels.

The following question was submitted to our correspondents: "What proportion of the total area of your township or county was this year planted in corn?" The answers to this inquiry are quite variable, as will be seen by reference to the table. The average of their estimates, for the State, is 22½ per cent. This would indicate that our total acreage in corn is 7,875,000 acres. This we do not accept as fully conclusive, but we believe the results of further inquiry will show that the total acreage is below, rather than above, these figures. Making allowance for all drawbacks and possible mistakes in estimates, we place the total yield of corn, in Iowa,



this year at over 800,000,000 bushels. This, of course, is subject to revision after the December report is made.

The results of threshing, since the August report, show an increased yield of oats over the estimates then made. The average is placed at  $41\frac{1}{2}$  bushels per acre. This will make the total for the State, in round numbers, 120,000,000 bushels.

The yield of winter and spring wheat has also been found to be greater than the August estimates. The average of winter wheat is placed at  $20\frac{1}{2}$ , and spring wheat at  $15\frac{1}{2}$ . This would show an output of a little over 34,000,000 bushels, on the basis of the acreage reported.

The yield of barley is estimated at 29 bushels per acre, giving a total of 4,785,000 bushels.

Flax is rated  $11\frac{1}{2}$  bushels per acre, and the estimated yield is about 3,314,370 bushels.

Irish potatoes have made an immense yield. The average condition is placed at  $108\frac{1}{2}$  per cent, and the yield per acre  $159\frac{1}{2}$  bushels. This would indicate a total output of over 28,000,000 bushels. The December crop report is likely to increase these figures.

Of rye the estimated yield is 20 bushels per acre, and the total for the State will be about 2,051,000 bushels.

Buckwheat is estimated at  $17\frac{1}{2}$  bushels per acre, but the acreage is not over 22,000.

The average yield of tame hay is reported at  $1\frac{1}{2}$  tons per acre, which is a fair estimate. This would give a total of about 4,500,000 tons. There is no estimate of the output of wild hay, clover and millet. The supply of forage will be fair.

The condition of sorghum is placed at 93 per cent, grapes 103 per cent, pastures  $86\frac{1}{2}$  per cent, meadows  $90\frac{1}{2}$  per cent.

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## DECEMBER CROP REPORT.

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### FINAL REPORT OF THE YEAR, SHOWING YIELD AND AVERAGE MARKET PRICES OF STAPLE CROPS.

The round-up of the season's products shows that 1891 was the most prosperous year ever enjoyed by the husbandmen of Iowa. It was exceptional in this, that nearly all the products of the fields, orchards, vineyards, gardens and forests were up to the average, and some of them largely in excess. And it was timely and providential, from the fact that there was great shortage in the staple crops of the old world. In feeding the nearly destitute millions of Europe, Iowa will bear its full share in the months that must intervene before another harvest is garnered.

**CORN.** The average yield of this great staple, as tabulated from the reports of over nine hundred correspondents, is 38 bushels per acre. The table giving the average by counties shows considerable variation in the estimated yield, affording a graphic illustration of the damaging effects of

June floods in the northwest, the hail and wind storms of July 1st, and the extensive wind squall of August 9th. The lowest average reported is 23 bushels per acre in Decatur county, which suffered heavily from hail, wind and flood. Some exceptionally high averages are reported to offset the shortage in portions of the State, as for example: Henry county, 51 bushels; Linn, 49; Washington and Louisa, 48; Muscatine, 47; Marion, 46; Iowa, Cedar, Keokuk and Warren, 45. Thirty-eight counties report an average exceeding 40 bushels per acre, and only 26 counties return a yield below 35.

According to Secretary Shaffer's estimate the acreage in corn this year was 8,816,621. This gives a total yield of 335,031,598 bushels, exceeding the highest yield of previous years.

The average market price reported, December 1st, was 30 cents per bushel. The crop was therefore worth \$100,509,479, when ready for market. As the bulk of the corn will be fed at a profit above the current value when cribbed, or will be held for much better prices in the coming months it is safe to estimate that Iowa will, this year, be made \$125,000,000 richer by its bountiful crop of corn.

The Statistician of the Department of Agriculture estimates the area in corn in Iowa for 1889 at 8,859,898 acres, which is above 40,000 acres in excess of Secretary Shaffer. The Director of this service has, therefore, no other official guide in making computations of crops, and these figures must be accepted as approximately correct. It is to be hoped that the intelligent farmers in the Twenty-fourth General Assembly, will devise some practical method of gathering reliable figures as to acreage in crops, through the township assessors, as is the practice in other States. This is respectfully referred to the members of the incoming legislature.

**OATS.** The average yield for the State is 40 bushels per acre. This crop shared to some extent the weather conditions that affected the corn crop. The growth of straw was very heavy in nearly all parts of the State. The acreage is 2,895,270, giving a total yield of 115,810,800 bushels. The average market value December 1st was 23 cents, making a total value of \$26,636,484. There has been a general appreciation in price, and it is safe to estimate that the oats crop of Iowa will be worth above \$30,000,000 to the producers.

**WHEAT.** The yield of winter wheat is averaged at 20 bushels per acre, and spring wheat, 15 bushels. The acreage, as given by Secretary Shaffer, is 2,071,968 acres, and averaging the yield at 16 bushels for both winter and spring wheat, the total is 33,151,488 bushels. This, at an average of 78½ cents per bushel (a very low estimate), is worth \$25,941,039.

**RYE.** The yield of this cereal, as shown by the October report, was 20 bushels per acre. The area planted was 102,570 acres, giving a total yield of 2,051,400 bushels. The average market price is 65 cents per bushel, making the total value of the crop \$1,333,410.

**BARLEY.** The average yield of winter barley is placed at 22½, and spring barley, 29 bushels per acre. The estimated acreage of spring barley is 156,161, and the output of this crop is about 4,528,669 bushels. At current market price this crop is worth \$1,710,038 to the producers.

**FLAX.** The average yield of this crop is placed at 10½ bushels per acre. The acreage is estimated at 295,689, giving a total yield of 3,154,016 bushels.

This, at the average local price of 80 cents per bushel, yields a total value to the producers of \$2,528,212.

**BUCKWHEAT.** The average of this crop is 18 bushels per acre. The acreage is estimated at about 23,000, giving a yield of about 414,000 bushels. This at 66½ cents per bushel, gives a total value of \$276,000. There was a considerable increase in acreage of this crop over former years, but the percentage of increase is not reported. The output is probably larger than above given.

**TIMOTHY SEED.** Average yield, 1½ bushels per acre. We have no means at hand of ascertaining the actual or approximate acreage of this crop. The average price per bushel is reported to be \$1.16.

**CLOVER SEED.** Average yield, 1½ bushels per acre. Market price, \$4.10. Acreage unknown.

**IRISH POTATOES.** The average yield is reported to be 143 bushels per acre. The highest averages are as follows: Clayton and Crawford, 200 each; Delaware, 196; Keokuk, 193; Carroll, 195; Van Buren, 186, Tama, 187; Humboldt, 185; Grundy, 185; Kossuth, 186; Black Hawk, 183; and ranging from these figures down to 71 per acre. The area planted was 180,425 acres, giving an estimated total yield of 25,620,350 bushels. The average market price December 1st was 21 cents per bushel, which makes the total value of the crop to the producers \$5,380,273.

**SWEET POTATOES.** Average yield, 90 bushels per acre. Acreage about 2,310. Total yield, 207,900. Average market price, \$1.00 per bushel. This estimate is probably much too low.

**MILLET SEED.** Average yield, 20½ bushels per acre. There are no market quotations reported, and the acreage is unknown.

**BROOM CORN.** Average yield, 1½ tons per acre. Acreage, 2,320 acres; giving a yield of 3,480 tons. Average price, \$77.75 per ton. Total value, \$270,570.

**HAY.** Average yield, 1½ tons per acre. Secretary Shaffer's estimate of the acreage of tame hay is 3,349,734 acres; this indicates a total yield of 5,582,890 tons. Average market price, \$6.25 per ton. Total value to producers, \$33,497,340. Of the yield and acreage of prairie hay we have no reliable data. Last year the crop of prairie hay and Hungarian forage grasses was valued at \$6,000,000. This year that amount will be considerably increased.

**SORGHUM.** The yield of sorghum is estimated at 99½ gallons per acre. Area planted, about 21,080 acres. Total yield, 2,092,485 gallons. Value at average of 43½ cents per gallon, \$904,718.

**MISCELLANEOUS.** Wool averages 21½ cents per pound. Milch cows average \$19.65 per head. Condition of pastures, 85½ per cent; meadows, 88½ per cent.

## GENERAL SUMMARY, 1891.

PRODUCTS.	Acreage.	Yield per acre.	Total yield.	Value.
Corn .....	8,316,621	38	335,031,598	\$ 100,509,479
Oats.....	2,895,270	40	115,810,800	28,636,484
Wheat.....	2,071,682	16	33,151,488	25,741,039
Rye.....	102,570	20	2,051,400	1,333,410
Barley.....	156,161	29	4,528,669	1,811,467
Flax .....	275,689	10½	3,154,016	2,523,212
Buckwheat.....	23,000	18	414,000	276,000
Timothy, Clover and Millet seed.....	.....	.....	Estimated	1,750,000
Irish Potatoes.....	180,425	142	25,620,350	5,380,273
Sweet Potatoes.....	2,310	90	207,900	207,900
Broom Corn .....	.....	.....	.....	270,570
Hay—tons.....	3,349,734	1½	5,582,890	33,497,340
Prairie Hay or other forage.....	.....	.....	Estimated	7,000,000
Sorghum.....	21,030	.....	.....	904,718
Total.....	.....	.....	.....	\$ 207,841,892

This summary gives the estimated market value of the staple products of the fields, not including fruits, garden, vegetables, etc. These products are used, in large part, as raw material in the manufacture of beef, horses, pork, dairy products, wool and poultry products, in the sale of which there is a very considerable increment of profit above relatively low market values at this time of the year. The above statement takes no account of pasturage, which may be fairly estimated to be worth \$75,000,000.

## WEATHER-CROP BULLETINS.

## SUMMARIES OF BULLETINS ISSUED DURING THE CROP SEASON OF 1891.

## BULLETIN No. 1.

CENTRAL STATION,  
DES MOINES, IOWA, April 11, 1891. }

Reports from all parts of the State indicate that the season is two to three weeks later than the average of recent years.

March brought a considerable excess of precipitation, in form of snow and rain, which, though greatly needed, made the roads well nigh impassable, and the fields were too wet for plowing or seeding until about the 4th inst. The rainfall of the present week was about the normal amount in the central and southern districts. Being followed by clearing, warmer weather it is beneficial to grass and fall grain. The frost is generally out of the ground, and seeding will now progress rapidly, with more favorable conditions.

The temperature of the week, at the Central Station, was 39° below normal—an average deficiency of 5.5° per day. The average deficiency in the

State was about  $6.5^{\circ}$  per day. Freezing temperature was reached on the 4th, 5th, 6th and 7th.

High east wind prevailed on the 8th, reaching a maximum velocity of 37 miles per hour, as recorded at the Central Station. This was followed by a thunder-storm in the evening, and damage by lightning is reported from Marshall county.

Forage is exceedingly scarce in all parts of the State, and farmers are anxiously awaiting the appearance of grass for their stock.

Though the season is late the present conditions are not unprecedented, and there is yet ample time for seeding and securing a harvest of old-time proportions. The outlook is especially favorable for fall wheat, grass and fruit.

#### BULLETIN No. 2.

CENTRAL STATION, }  
DES MOINES, IOWA, April 18, 1891. }

The temperature of the week was above normal throughout the larger part of the State. At the Central Station there was an excess of 25 degrees—about  $3\frac{1}{2}$  degrees per day. There was, however, but little sunshine to quicken vegetation, and put the soil in the best condition for working.

There was an excess of rainfall in nearly all the districts of the State, except the northeast and portions of the eastern central. At Keokuk the excess was 1.71 inch.

In general the crop conditions are somewhat improved. About 80 per cent of the seeding of small grain is completed, and the early sown grain is sprouting. Winter wheat and rye are very promising. Grass is starting well, and pastures will generally be in condition for grazing within ten days.

There was never a better prospect for fruit.

#### BULLETIN No. 3.

CENTRAL STATION, }  
DES MOINES, IOWA, April 25, 1891. }

The temperature of the past week averaged 8 degrees daily above normal. At the Central Station the excess for the week was 55 degrees.

The amount of rainfall was generally above the seasonable average. The following counties report a large excess: Butler, 2.25 inches; Bremer, 2.00; Allamakee, 2.20; Scott, 1.63; Floyd, 1.50; Lee, 1.46; Wayne, 1.47; Benton, 1.52; Woodbury, 1.37; Howard, 1.35; Black Hawk, 1.25. In the larger portion of the State there is no more moisture than is needed.

The high temperature, frequent showers and average amount of sunshine have caused a rapid growth of all vegetation, and greatly improved the crop outlook. Winter wheat, grass, and most spring grain crops are looking well. Seeding is practically completed, except in a few counties. Plowing for corn is in progress, and in a few southern counties planting has begun.

The season has been late, but all the conditions are helping to make up lost time. Fruit prospects continue very flattering.

## BULLETIN No. 4.

CENTRAL STATION,  
Des Moines, Iowa, May 2, 1891. }

The average daily temperature of the past week was 6 degrees above normal throughout the State, and there was more than an average amount of sunshine.

Brisk and warm winds prevailed two days, drying the soil rapidly, facilitating farm work in sections where it had been previously delayed by surplus moisture. In some sections the drying process was so rapid as to form a crust on the surface. Light frosts are reported but no appreciable damage resulted.

In the larger portion of the State there was no more than a trace of rainfall during the week. The greatest measurements reported were in the West Central and South-East districts, ranging from .01 to 0.40 of an inch.

The conditions have been highly favorable for farming operations. Plowing for corn is in progress, and a fine beginning has been made in planting. Grass and grain are doing well, and pasturage is further advanced than usual at this date.

Fruit trees are in bloom, with excellent promise of a large crop. The light rains that came at the close of the week (Saturday morning) were timely, and quite well distributed.

## BULLETIN No. 5.

CENTRAL STATION,  
Des Moines, Iowa, May 9, 1891. }

The past week was unseasonably cold and dry. The average daily temperature throughout the State was 6° below normal. From the morning of the 3d to the 8th there was a prevalence of high barometric conditions, and every section of the State reports frost and ice on two or three consecutive dates.

The damage to fruit and tender garden vegetables is confined almost wholly to the central and southern districts, wherein the growth was most advanced. As usual the blighting effects of frosts are most apparent on bottom lands. Within the southern districts it is probable that the loss of fruit by freezing will amount to 10 to 15 per cent. In the Central and Northern districts it will range from 5 to 10 per cent. But allowing the full extent of damage, with favoring conditions in the future, Iowa will this year produce an unprecedented crop of fruit.

There was an average deficiency of about an inch in the seasonable rainfall. This with the low temperature temporarily checked the heretofore rapid growth of vegetation, but no permanent injury has yet resulted to any field crop. Considerable progress has been made in corn planting, and the bulk of it will be completed before the 15th. Early planted corn is well sprouted.

## BULLETIN No. 6.

CENTRAL STATION,  
Des Moines, Iowa, May 16, 1891. }

The average temperature of the past week was about normal, the first half being below and the last half above. On the morning of the 11th

there was a general frost, with ice on low ground. The damage reported is slight; tender garden plants and early strawberries suffering most injury. The prospect for fruit is yet very promising.

The average rainfall for the State was far below normal, the quantity reported in the northern and central districts being very light. The southern districts were quite copiously watered on Sunday. And the Missouri valley was favored by showers on Friday evening, the extent of which the reports do not indicate.

The lack of a seasonable quantity of rain is being seriously felt in nearly all sections of the State, and there will be a material damage to the hay and small grain crops if the prevailing drought is not broken within the coming two weeks.

Corn planting is practically completed in all parts of the State, except in localities where plowing was delayed by exclusive moisture in the early spring. The seed has germinated in good time, and in many fields the work of cultivation is begun.

#### BULLETIN No. 7.

CENTRAL STATION, }  
DES MOINES, IOWA, May 23, 1891. }

The daily average temperature of the week was about 3 degrees below normal. About an average amount of sunshine prevailed.

The drought is broken by copious rains which fell on the 20th, 21st, and 22d, and the languishing crops have been revived and greatly benefited. In more than half the State the measurement was two to three inches, the southern and central districts receiving the larger amount. Reports from a few northern localities mailed on the 21st, indicate that the heavy rainfall of that date did not extend to all parts of the State. But every section has been benefited to some extent, and three-fourths of the State has been abundantly watered.

The crop outlook is greatly improved. Corn planting is practically completed; the early planted shows a good stand and color, except in localities where it is damaged by cut and wire worms.

The fruit prospect is generally very good.

#### BULLETIN No. 8.

CENTRAL STATION, }  
DES MOINES, IOWA, May 30, 1891. }

The average daily temperature of the week was 6° below normal. Light frosts are reported on three mornings in all districts of the State, but the damage is inconsiderable.

The rainfall was very light, and not well distributed, the bulk of it falling in scattered localities in the central and southern districts. Cass county reports 1.88 inch. Harrison, 0.75; Crawford, 0.87; Pottawattamie, 1.20 and Mahaska, 1.00.

A special dispatch received to-day (May 30th), from Observer Moses Simon, of Carroll, reports 2.50 inches of rain between 1:00 and 7:00 A. M., this date. And Sioux City reports 0.72 this morning. This indicates good prospect of a distribution of moisture in the section where it is most needed.

The general weather conditions, as affecting crops during the month of



May, 1891, will compare very favorably with May, 1890. The average temperature was about the same and the average rainfall somewhat greater than last year. On the whole the crop outlook is more promising than at the corresponding date in 1890.

There will be considerable replanting of corn made necessary by the depredations of the cut-worm; but the season of that destroyer is about at an end, and there is yet ample time to remedy a large portion of the damage wrought.

In the central and southern districts where the rainfall was heaviest, the prospect is good for small grain and grass. Winter wheat is doing well, except in Des Moines and Louisa counties, where the Hessian fly has been quite destructive.

#### BULLETIN No. 9.

CENTRAL STATION,  
DES MOINES, IOWA, June 6, 1891. }

The temperature of the past week averaged about normal, the excess of the early part being overbalanced by the deficiency of the last two days. The amount of sunshine was below normal.

The rainfall has been ample in all parts of the State, and excessive in many localities. The west, central and northwest districts report the heaviest precipitation.

The crop outlook is greatly improved. Corn has made a fine start, and is generally in better condition than at corresponding date last year. A portion of the damage by cut-worms has been repaired by replanting. Fruit prospects continue very good.

Stock is generally healthy; but in Pottawattamie county a new form of disease is reported among horses; said to resemble distemper, but more virulent.

#### BULLETIN No. 10.

CENTRAL STATION,  
DES MOINES, IOWA, June 18, 1891. }

The past week was unseasonably cool and cloudy. The average daily deficiency of temperature was about six degrees and at the Central Station the cloudiness was 80 per cent. There was, however, no frost and no bad effects are noted except checking the growth of corn.

The amount of rainfall was quite variable, but all portions of the State received a sufficiency of moisture for present necessities, and in some localities there was considerable excess. The heaviest measurements are reported from the S. C., S. E. and Central districts.

All crops are doing fairly well, and considerable improvement is noted in the condition of grass and small grain in the northern districts where the May drought was most severe. In the southern counties fall wheat and oats have made an excessive growth of straw, which is the only visible danger to those cereals.



## BULLETIN No. 11.

CENTRAL STATION,  
DES MOINES, IOWA, June 20, 1891. }

Warm, growing weather, with an average amount of sunshine, prevailed the first half of the past week. The last half was cloudy, rainy and cooler. The daily average temperature of the week was about 1 degree above the normal.

The average rainfall in the State was excessive. It is safe to say the drought is quite effectively broken, and it is an agreeable break of the monotony of complaint to hear of too much moisture. All sections of the State have had an abundance, and in many counties the precipitation of the week will go far toward making up the normal amount for the year. Following are some of the heavier measurements reported: Buena Vista, 5.66 inches; Wright, 4.20; Washington, 4.82; Cass, 4.66; Carroll, 3.25; Cherokee, 3.38; Ida, very heavy, (estimated 16 inches(?)) and very destructive to railroad property, crops and bridges; Adams, 2.95; Hancock (Stilson), 8.50; Madison, 3.48; Fayette, 3.18; Benton, 2.77; Des Moines, 2.45; Polk, 2.60; Audubon, 2.30; Pottawattamie, 2.30.

These figures illustrate the quite general down pour. The northern counties, wherein the drought had been most severe, appear to have had the heaviest rainfall.

The general effect on crops, in the State at large, will be very beneficial, if it is succeeded by favorable weather for cultivating corn, and the ripening of grain. But the heavy storms wrought considerable damage in many localities, by washing out corn and flooding crops on bottom lands. In many sections, in the southern districts, small grain crops show a tendency to lodge, and it is probable there will be considerable loss from that cause. Clear weather and sunshine however, may largely remedy that trouble. On the whole, the crop outlook is good.

## BULLETIN No. 12.

CENTRAL STATION,  
DES MOINES, IOWA, June 27, 1891. }

The average daily temperature of the past week was about two degrees above normal, with an average amount of sunshine.

The rainfall was very light in the eastern and averaged about normal in the northern central, central and southern central districts. On the night of the 23d and on the 24th, the northwestern district was swept by a storm of almost unprecedented severity and extent. It was accompanied by wind squalls of sufficient force in some localities to unroof buildings and level the more frail wooden structures. No reliable measurements are yet received of the amount of rainfall, but it was sufficiently heavy to cause very destructive floods along all the streams in a territory covering the area of nine counties. The total loss of property cannot yet be estimated, but the aggregate will probably not fall short of a million dollars, and is more likely to exceed that sum.

The effect of the storm extended across the State along the Missouri slope in the form of excessive rainfall, but the damaging results were confined almost wholly to the northwestern counties.

In the larger portion of the State crop prospects are good. Corn is generally doing well, attaining very nearly an average condition. Wheat harvest has begun in a few localities. Oats are too heavy in all the southern and central districts, and some damage by lodging and rust is reported. The hay crop will be larger than previous reports indicated.

## BULLETIN No. 13.

CENTRAL STATION,  
DES MOINES, IOWA, July 3, 1891. }

Temperature and sunshine during the past week were slightly below normal.

Rainfall was ample in all parts of the State, and excessive in many localities, as the reports will show. On the afternoon of the 1st inst., a heavy storm, or series of storms, with accompaniment of wind squalls, hail, excessive rain and lightning, formed somewhere in Cherokee or O'Brien, and swept diagonally across the State to Decatur county. Reports of heavy damage wrought thereby come from stations in Buena Vista, Carroll, Audubon, Guthrie, Adair, Union, Clarke and Decatur counties. Hail stones of marvelous size and great quantities, fell in strips of from two to six miles in width, along this pathway of disturbance, about two hundred miles in length. The heaviest damage appears to have been done in Audubon, Adair and Decatur counties. Within a strip five miles in width, the destruction of all growing crops was well nigh total, and numbers of horses were killed or ruined by being driven into wire fences.

In general the crop conditions are very favorable. Haying is progressing in all parts, and the yield is good. The harvest of winter wheat and rye has begun in the southern counties, and in many localities the grain is all in shock. The oat crop bids fair to be the heaviest ever grown in the State.

## BULLETIN No. 14.

CENTRAL STATION,  
DES MOINES, IOWA, July 11, 1891. }

The daily average temperature of the past week was about 8° below normal throughout the larger part of the State. Davenport is the only station reporting an excess. It was the coolest July week recorded in the past twenty years. The low temperature was very favorable to small grain, checking the tendency to rust and blight, which had already caused much damage in many localities.

The rainfall has been excessive in the larger part of the State, especially in the East Central and Northeast districts. This, with the previous saturation of the soil, has been unfavorable to most crops; and a very considerable amount of hay has been damaged after cutting.

Winter wheat and rye are in shock in southern districts, and the quality is good. Haying is in progress in all sections, with promise of a full average yield. Oats rank in growth, and the yield will be reduced considerably by rust and lodging. Corn has made a vigorous struggle for existence, and with favoring weather in the future may yet recover a good portion of its lost estate.

## BULLETIN No. 15.

CENTRAL STATION,  
DES MOINES, IOWA, July 18, 1891. }

The daily average temperature of the past week was about 5 degrees below normal throughout the State, with an average amount of sunshine, making favorable conditions for haying and harvesting.

The amount of rainfall was generally below the seasonable average, but it was ample for all present needs. On Monday a severe wind storm wrought some damage in a few localities in the eastern districts.

Harvest of spring grain is in progress in the southern half of the State, and in the northern districts the early seeded fields are ready to cut. The hay crop is mostly secured, and is generally better than was expected.

Corn is doing fairly well, but warmer weather is needed to make an average crop. Potatoes and flax are very promising.

## DESTRUCTIVE INSECTS.

Numerous crop reports have referred to certain unknown insects infesting wheat fields, and two correspondents (Geo. Valet, of Muscatine, and O. G. Van Winkle, of Burlington,) sent specimens of the pests. These were forwarded to Prof. Herbert Osborn, entomologist of the Agricultural College, who reports as follows: "The insects sent by your observers are the Wheta Aphis (*siphonophora avenæ*.) This has been quite abundant in some parts of the State this season and has caused considerable damage, but fortunately the parasites have multiplied in great numbers so that in every set of specimens sent me all, or nearly all the aphides have been destroyed by the parasites, and I learn from some correspondents that their fields have been practically freed from the pests in this way. I believe therefore there is no need for special alarm about the pests in this State."

## BULLETIN No. 16.

CENTRAL STATION.  
DES MOINES, IOWA, July 25, 1891. }

The past week has been cool, the daily average temperature being about 6° below normal, and in portions of the State the amount of sunshine was deficient.

The amount of rainfall was largely in excess of the seasonal average in all parts of the State, except portions of the S. E. and E. C. districts. The electric storm on the night of the 21st and morning of 22d was accompanied by high wind in many localities and considerable damage is reported by lightning and floods and the leveling of growing crops. The harvest was delayed but no irreparable damage has been done.

In the southern and central districts spring grain is mostly harvested and threshing has begun. In the northern districts harvesting is in progress. Making due allowance for damage by rust, lodging and insects, with favoring conditions for securing the crops, the State will this year produce at least an average amount of hay, oats, barley, flax, wheat, and potatoes. Pasturage is unusually good. Corn is late, and to make an average crop must have warm weather throughout August and the larger part of September.

BULLETIN No. 17.

CENTRAL STATION,  
DES MOINES, IOWA, August 1, 1891. }

The daily average temperature of the week was about 6° below normal. This closes the record for the month, making it the coolest July, with one exception, since 1879. The following table gives, as a basis of comparison, the mean temperature and total precipitation for the month of July, at Des Moines, for the years from 1879 to 1891, inclusive:

YEARS.	Mean temp, degrees.	Precipita- tion, inc's.
1879 .....	77.9	0.20
1880 .....	77.4	3.82
1881 .....	76.2	5.57
1882 .....	68.4	4.78
1883 .....	73.6	2.37
1884 .....	71.8	2.16
1885 .....	75.9	6.55
1886 .....	78.4	0.27
1887 .....	77.5	1.94
1888 .....	75.6	3.42
1889 .....	73.8	4.37
1890 .....	76.9	1.10
1891 .....	68.7	2.78

The rainfall during the week was much below the seasonable average; but a few localities report an excess. There was a deficiency in sunshine, but generally the weather was very favorable for harvesting and threshing operations, which are in progress in all parts of the State. Corn shows a healthy color and is doing as well as could be expected. Threshers report a handsome yield of small grain. The hay crop is heavy, and the prospect is flattering for flax and potatoes.

BULLETIN No. 18.

CENTRAL STATION,  
DES MOINES, IOWA, August 8, 1891. }

The daily average temperature of the past week was about one degree below normal, the excess during the last three days about balancing the deficiency of the preceding days. There has been a full average amount of sunshine.

The rainfall has been ample, though generally below the seasonal average, except in portions of the S. W. district and a few other localities, which report quite heavy showers.

The weather has been generally very favorable for harvest work and threshing, and the small grain crops are mostly secured in all portions of the State. Reports of threshers are very flattering, and there is a probability that the round-up of the year will show a considerable increase in the yield per acre of oats and wheat over the averages of the regular August report.

Corn has made fine progress during the week, and the outlook for that crop is decidedly improved since August 1st. Five or six weeks of favorable weather will insure a handsome yield of that staple.

A number of fatal cases of "black tongue" are reported among the cattle near McCausland, Scott county.

SUMMARY OF AUGUST CROP REPORT.

Following are the averages for the State of the several crops, based on the estimates of about 1,000 correspondents, tabulated August 1, 1891:

CROP.	Per cent.	CROP.	Yield per acre, bushels.
Corn.....	89½	Winter wheat.....	20½
Broom corn.....	92	Spring wheat.....	14½
Sorghum.....	91½	Winter barley.....	25
Flax.....	99½	Spring barley.....	28 1-6
Buckwheat.....	85	Winter rye.....	20
Millet.....	100½	Spring rye.....	18½
Meadows.....	101½	Oats.....	30½
Pastures.....	103½	Hay, tons.....	1½
Irish potatoes.....	110½		
Sweet potatoes.....	98		
Apples.....	92½		
Grapes.....	101		

BULLETIN No. 19.

CENTRAL STATION,  
DES MOINES, IOWA, August 15, 1891. }

The daily average temperature throughout the State was from one to two degrees above normal, the first half of the week being considerably warmer than the latter half. Sunshine was quite variable, but generally about an average obtained.

The amount of rainfall was in excess of the seasonal average, but it was not well distributed. Following are some of the heavier measurements reported: Henry, 3.80; Louisa, 3.50; Davis, 4.87; Black Hawk, 8.25; O'Brien, 2.91; Muacatine, 2.49; Wright. 2.20; Linn, 2.70; Hancock, 2.00; Iowa, 3.80; Hamilton, 2.12; Wayne, 2.96; Palo Alto, 1.96; Johnson, 1.95; Jones, 1.94.

On the 9th a heavy wind and rain storm, originating in Ringgold or Decatur county, swept through the south central and southeast districts to the Mississippi river and beyond, the general direction being a little north of east. The width of the belt of disturbance at its inception was fifteen to twenty miles; and it was fully fifty miles wide when it reached the river. It was a wind-squall of unprecedented force (not a tornado or "cyclone," as reported) and the damage to growing crops, stacks and shocks of grain and hay, buildings and fruit was very heavy in the aggregate, though the first reports were probably exaggerated.

On the 13th a belt of hail passed through O'Brien and Decatur counties, causing heavy damage, estimated by one observer at a half million dollars.

On the whole the week has been favorable to corn, which is making satisfactory progress toward maturity. In many sections it has attained a phenomenal size, and with favorable conditions a fair crop will be secured. In some localities grain in stacks and shocks has been sprouted by excess of moisture.

## BULLETIN No. 20.

CENTRAL STATION,  
DES MOINES, IOWA, August 22, 1891. }

The daily average temperature has been about 8° above normal, the week ending with a cool wave verging close to the frost line. A large percentage of cloudiness reduced the amount of sunshine below normal.

Precipitation was largely in excess in the greater part of the State, resulting in damage to grain in shocks and stacks. In some sections the loss from this cause will be seriously felt, and the experience this year gives another instance of the danger attending the general method of waiting to thresh from the shock. Those who have their grain securely housed or sheltered are in luck.

Corn has made rapid growth, and a month of favorable weather will mature the greater part of the crop. The pasturage of the State is as abundant and as green as in June, and potatoes will yield immensely. Despite all drawbacks of heavy storms and incidental local damage, the season will bring abundant rewards to the producers of food.

## BULLETIN No. 21.

CENTRAL STATION,  
DES MOINES, IOWA, August 29, 1891. }

This has been the coldest August week experienced in Iowa within the past twenty years, the average daily deficiency in temperature being about ten degrees. Light frosts are reported as occurring in every district of the State on the 23d and 24th inst., and at numerous points on the 22d and 28th. The amount of sunshine was generally below normal.

Very light precipitation is reported for all parts of the State, but the amount is sufficient, and in some localities the prevalent humidity and cloudiness caused damage to grain in shocks and stacks.

There has been no material damage by frosts, only the tenderest vegetation being injured in exposed localities. But the weather has been unfavorable for maturing corn, about thirty per cent of which is too far behind to ripen under normal weather conditions in the coming month. Two to three weeks of favorable weather will place the bulk of the crop beyond danger. Potatoes are generally doing well, but a tendency to rot has been caused by excessive moisture in a few places.

## BULLETIN No. 22.

CENTRAL STATION,  
DES MOINES, IOWA, September 5, 1891. }

The past week was cool and dry, the average daily temperature being 6 degrees below normal. A cool wave brought the temperature down very close to the danger line on the mornings of the 3d and 4th. Frosts are reported from every district in the State, but the damage is light. The amount of rainfall was generally below the seasonal average, but there is little lack of moisture in any part of the State.

The week has been favorable for threshing and fall plowing. There will be a considerable increase in the acreage of fall wheat and rye.

Corn has made slow progress, and at least two weeks of favorable weather is needed to place the bulk of the crop beyond danger from heavy frosts. About one-third of the crop will require nearly a month to ripen, and the present prospect is that there will be more than the usual quantity of soft corn in the State this year. If cut before killing frost the belated fields will make good forage, but will not possess much fattening value.

All other crops are very good, and only an average corn crop is needed to make it a season of unprecedented productiveness.

BULLETIN No. 23.

CENTRAL STATION,  
DES MOINES, IOWA, September 12, 1871. }

The daily average temperature of the week was three degrees below normal. There was an excess of sunshine, and the warm days counterbalanced the effects of the cool nights, making it a generally favorable week for maturing the crops.

The rainfall was generally deficient, large portions of the State reporting no precipitation up to Friday. There was, however, a slight excess of precipitation reported on the 7th and 8th in a number of counties in the Northern Central and Central districts. The rain on Friday night was quite general, but not heavy.

Corn has made fair progress, and its present situation in the State at large may be stated as follows: About one third of the crop is sufficiently matured to cut and shock, or substantially safe from *serious* harm by frost. Eight to ten days of good ripening weather would place two thirds of it beyond danger. The remaining third needs all of September and a little of October to get through in good shape. The present outlook does not warrant the expectation of securing more than 70 per cent of sound, merchantable corn, though the belated fields would yield much valuable feed for stock if cut and shocked before freezing weather.

Other crops are doing well. Plowing and wheat sowing are in progress. The potato harvest is begun in some localities, with heavy yield.

TO OBSERVERS: Please make a careful study of the corn situation, and report next week the proportion of the crop that is safe, and how much time is needed by the balance.

BULLETIN No. 24.

CENTRAL STATION,  
DES MOINES, IOWA, September 19, 1891. }

The daily average temperature of the past week was over nine degrees above the normal, making it the hottest seven days ever recorded in this latitude in the second decade of September. There was a full week of unobscured sunshine.

It was a golden diadem, crowning a most beautiful season! There was no rain by day, nor chill by night, and in the drying winds the rustle of the corn blades was like an anthem of rejoicing.

In the State at large fully three fourths of the corn is practically secure, and more than the usual proportion of the crop is being cut and shocked.



About 25 per cent is yet more or less immature, needing from one to two weeks to fully ripen.

There is a large per cent of unripe corn in the districts wherein there was the greater excess of moisture in July and August.

The present prospect is that the State, as a whole, will produce 85 per cent of a full crop of sound corn.

Rain is needed for pastures and to facilitate plowing.

BULLETIN No. 25.

CENTRAL STATION, }  
DES MOINES, IOWA, September 26, 1891. }

The daily average temperature of the past seven days was about 15° above the normal, and with one exception it was the hottest week of the year. For the last decade of September it was wholly unprecedented in this State. The amount of sunshine was much above the average, and the precipitation was generally very light, a few localities reporting a fine shower on the 24th. The prevalent droughty conditions have materially affected the pasturage, shortened the supply of stock water, and retarded plowing and seeding of fall grain.

The corn crop is practically secure, and not more than the usual proportion will be soft or chaffy. The total yield will be beyond the most sanguine estimates made a month ago. The acreage in Iowa has undoubtedly been over-estimated; and of the amount actually planted there has been a reduction of five to ten per cent occasioned by flooding, hail and wind storms, depredations of cut-worms, etc. But making due allowance for all these drawbacks, this State will probably produce 300,000,000 bushels of sound corn this year. As nearly all other crops have been exceptionally heavy, the year of grace, 1891, will score a record as the most bountiful all-around crop season ever known in the history of this State.

The yield of oats will probably exceed 120,000,000 bushels, and the State will produce fully 20,000,000 bushels of potatoes.

An increased acreage of winter grain will be sown if the drought is broken within a week.



# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT ALTA, BUENA VISTA COUNTY.

BY H. H. PETERSON, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	25.4	50	-1	1.36	14	NW
February.....	.....	.....	12.7	40	-10	1.37	12	.....
March.....	.....	.....	22.6	48	-10	1.77	10.5	.....
April.....	.....	.....	47.1	80	18	2.12	...	NW
May.....	.....	.....	60.8	85	34	2.93	.....	.....
June.....	.....	.....	68.0	91	44	16.02	.....	NE
July.....	.....	.....	65.4	90	45	6.18	.....	.....
August.....	.....	.....	64.9	91	41	5.64	.....	.....
September.....	.....	.....	67.8	90	39	2.04	.....	.....
October.....	.....	.....	48.7	75	28	5.78	T	.....
November.....	.....	.....	26.9	66	-16	.91	7.0	.....
December.....	.....	.....	29.3	50	-9	2.49	3.0	.....
Sums.....	.....	.....	539.6	856	147	48.60	46.5	.....
Averages.....	.....	.....	45.0	71.3	12.2	4.05	.....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	22.5	46.7	-6.7	5.22	.....	.....
Spring months.....	.....	.....	43.5	71.0	14.0	6.81	.....	.....
Summer months.....	.....	.....	66.1	90.7	43.3	27.84	.....	.....
Autumn months.....	.....	.....	47.8	77.0	17.0	8.73	.....	.....

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT ALTA, BUENA VISTA COUNTY.

BY DAVID E. HADDEN, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	24.4	50	-10	1.76	14.0	NW
February.....	.....	.....	13.2	42	-16	1.37	12.0	NW
March.....	.....	.....	24.3	50	-10	1.77	10.5	NW
April.....	.....	.....	48.8	85	18	2.12	10.0	NW
May.....	.....	.....	57.3	85	35	2.92	.....	S
June.....	.....	.....	69.0	91	45	16.02	.....	NE
July.....	.....	.....	67.5	87	45	6.21	.....	SE
August.....	.....	.....	67.6	94	40	5.64	.....	S
September.....	.....	.....	66.0	88	37	2.04	.....	S
October.....	.....	.....	47.9	75	28	5.78	T	NW
November.....	.....	.....	27.0	66	-16	.91	7.0	NW
December.....	.....	.....	28.6	50	-9	2.40	3.0	NW
Sums.....	.....	.....	541.6	863	185	49.05	56.5	.....
Averages.....	.....	.....	45.1	71.9	15.4	4.09	.....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	22.1	47.3	-9.3	5.64	.....	.....
Spring months.....	.....	.....	43.5	73.3	14.3	6.81	.....	.....
Summer months.....	.....	.....	68.0	90.7	43.3	27.87	.....	.....
Autumn months.....	.....	.....	47.0	76.3	16.3	8.73	.....	.....

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT AMANA, IOWA COUNTY.

BY CONRAD SCHADT, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	25.3	43.5	1	1.94	2.5	NE
February.....	.....	.....	22.8	50.0	-10	1.28	1.5	NW
March.....	.....	.....	26.9	50.0	-4	3.25	18.0	NE
April.....	.....	.....	50.8	82	20	1.51	...	NW
May.....	.....	.....	57.1	86	29	4.83	...	NE
June.....	.....	.....	69.2	91	49	4.80	...	S
July.....	.....	.....	67.8	89	44	2.66	...	NW
August.....	.....	.....	68.4	94	40	5.20	...	S
September.....	.....	.....	66.1	88	37	2.20	...	S
October.....	.....	.....	49.7	84	26	2.01	...	NW
November.....	.....	.....	30.8	58	-13	2.86	3.5	NW
December.....	.....	.....	32.2	55	10	1.58	2.0	SE
Sums.....	.....	.....	567.1	879.5	220	34.10	27.5	.....
Averages.....	.....	.....	47.3	73.3	19.3	2.84	.....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	26.8	52.5	2.7	4.78	.....	.....
Spring months.....	.....	.....	44.9	72.7	15.0	9.59	.....	.....
Summer months.....	.....	.....	68.5	91.3	44.3	12.66	.....	.....
Autumn months.....	.....	.....	48.9	74.0	16.7	7.07	.....	.....

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT ATLANTIC, CASS COUNTY.

BY J. W. LOVE, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	21.0	...	...	1.48	...	...
February.....	.....	.....	21.3	53	-20	1.66	...	NW
March.....	.....	.....	27.4	62	-8	1.61	9.8	NE
April.....	.....	.....	50.7	84	19	2.16	T	SE
May.....	.....	.....	57.2	85	23	6.68	...	NE
June.....	.....	.....	67.6	91	42	8.78	...	S
July.....	.....	.....	68.9	94	43	6.16	...	SE
August.....	.....	.....	68.1	97	34	1.72	...	S
September.....	.....	.....	65.9	96	29	1.94	...	S
October.....	.....	.....	50.2	85	-19	3.35	...	T
November.....	.....	.....	30.0	73	-8	.77	5.5	NW
December.....	.....	.....	34.2	60	-1	1.88	2.2	S
Sums.....	.....	.....	.....	.....	.....	38.19	17.5	.....
Averages.....	.....	.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	.....	.....	.....	5.02	.....	.....
Spring months.....	.....	.....	45.1	77.0	11.3	10.45	.....	.....
Summer months.....	.....	.....	66.2	94.0	39.7	16.66	.....	.....
Autumn months.....	.....	.....	48.7	84.7	13.3	6.06	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
BANCROFT, KOSSUTH COUNTY.

BY H. N. RENPREW, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation		
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			20.6	52	-4	1.20	11.0	NW
February.....			10.2	45	-27	2.00	9.0	NW
March.....			23.1	42	-12	1.56	8.0	NW
April.....			47.7	83	12	1.02		NW
May.....			58.1	82	37	1.46	T	S
June.....			66.4	86	41	4.83		S
July.....			67.0	87	43	1.67		S
August.....			68.1	93		3.48		S
September.....			65.8	86	33	2.26		S
October.....			46.8	75	22	4.33		NW
November.....			28.0	60	-19	.57	3.0	NW
December.....			28.8	52	-10	1.05	4.0	S
Sums.....			529.5	850	106	26.16	35.0	.....
Averages.....			44.1	70.8	8.8	2.18		.....
RECAPITULATION BY SEASONS—								
Winter months.....			19.9	49.7	-13.7	4.85		
Spring months.....			43.0	69.3	8.7	4.14		
Summer months.....			67.2	89.7		9.96		
Autumn months.....			46.5	74.7	12.0	7.21		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
BELLE PLAINE, BENTON COUNTY.

BY H. W. VANDYKE, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			22.1	41	-1	2.52	7	.....
February.....			22.1	41	-1	2.52	8.0	.....
March.....			22.1	41	-1	2.52	25.0	NE
April.....			22.1	41	-1	2.52	T	NW
May.....			22.1	41	-1	4.21		SE
June.....			22.1	41	-1	4.26		SE
July.....			22.1	41	-1	2.69		NW
August.....			22.1	41	-1	3.31		S
September.....			22.1	41	-1	1.23		S
October.....			22.1	41	-1	3.28		NW
November.....			22.1	41	-1	2.07	6.0	NW
December.....			22.1	41	-1	1.93	3.0	S
Sums.....						32.01	47.0	.....
Averages.....						2.75		.....
RECAPITULATION BY SEASONS—								
Winter months.....						5.34		
Spring months.....						10.78		
Summer months.....						10.26		
Autumn months.....						6.53		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
BLAKEVILLE, BLACK HAWK COUNTY.

BY JAS. RODGERS, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....								
February.....								
March.....								
April.....			50.4	84	20	2.54	1.0	
May.....			58.5	88	33	4.04		
June.....			69.5	96	51	4.72		
July.....			69.5	93	50	4.89		
August.....			70.7	103	47	6.54		
September.....			69.3	100	47	1.60		
October.....			52.1	82	31	2.59		
November.....			31.0	70	-16	2.29		
December.....			32.3	64	4	4.50	2.5	
Sums.....								
Averages.....								
RECAPITULATION BY SEASONS—								
Winter months.....								
Spring months.....								
Summer months.....			69.9	98.3	49.3	16.15		
Autumn months.....			50.8	84.0	20.7	6.48		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
BONAPARTE, VAN BUREN COUNTY.

BY HON. B. R. VALE, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....								
February.....								
March.....								
April.....								
May.....			64.1	82	40	2.78		
June.....			74.8	96	54	3.55		
July.....			74.9	92	58	4.64		
August.....			75.1	96	54	5.13		
September.....			73.9	94	.....	.90		
October.....			56.8	92	38	1.76	T	
November.....			35.9	64	- 6	3.62	0.2	
December.....			38.2	56	6	2.08	10.0	
Sums.....								
Averages.....								
RECAPITULATION BY SEASONS—								
Winter months.....								
Spring months.....								
Summer months.....			74.9	94.7	55.3	13.32		
Autumn months.....			55.5	83.3	.....	6.28		

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT CARROLL, CARROLL COUNTY.

BY MOSES SIMON, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	28.6	54	4	0.06	8.5	.....
February.....	.....	.....	15.6	51	-17	1.09	8.0	.....
March.....	.....	.....	24.8	54	-12	4.11	29.0	.....
April.....	.....	.....	50.0	85	17	2.92	T	.....
May.....	.....	.....	58.3	84	28	5.44	.....	.....
June.....	.....	.....	67.2	92	45	6.51	.....	.....
July.....	.....	.....	67.8	86	45	4.10	.....	.....
August.....	.....	.....	69.3	93	38	5.17	.....	.....
September.....	.....	.....	65.9	87	35	1.93	.....	.....
October.....	.....	.....	48.7	78	24	5.60	.....	.....
November.....	.....	.....	30.7	64	-13	1.09	9.0	.....
December.....	.....	.....	32.5	58	-4	2.71	5.0	.....
Sums.....	.....	.....	553.4	884	190	41.63	57.5	.....
Averages.....	.....	.....	46.3	73.7	15.8	3.47	...	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	24.9	53.7	-5.7	4.76	.....	.....
Spring months.....	.....	.....	43.7	74.3	11.0	12.47	.....	.....
Summer months.....	.....	.....	68.1	90.3	42.7	16.78	.....	.....
Autumn months.....	.....	.....	48.4	76.3	15.3	8.62	.....	.....

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT CEDAR FALLS, BLACK HAWK COUNTY.

PROF. A. C. PAGE, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	24.8	42.9	1.8	1.19	4.0	NW
February.....	.....	.....	16.4	.....	.....	1.17	11.7	NW
March.....	.....	.....	25.6	50.0	-3	3.01	16.3	NW
April.....	.....	.....	49.4	81	19	1.32	.....	NW
May.....	.....	.....	54.7	80	26	2.68	.....	NW
June.....	.....	.....	71.5	90	49	2.55	.....	.....
July.....	.....	.....	67.3	88	44	3.94	.....	NW
August.....	.....	.....	68.6	89	38	3.63	.....	S
September.....	.....	.....	68.0	91	35	2.39	.....	.....
October.....	.....	.....	50.1	80	24	2.77	.....	NW
November.....	.....	.....	29.0	58	-16	1.70	3.4	NW
December.....	.....	.....	30.6	54	-5	2.74	2.2	SE
Sums.....	.....	.....	554.0	.....	.....	29.07	37.6	.....
Averages.....	.....	.....	46.2	.....	.....	2.42	.....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	23.9	.....	.....	5.10	.....	.....
Spring months.....	.....	.....	43.2	70.3	14.0	6.99	.....	.....
Summer months.....	.....	.....	69.1	89.0	43.7	10.12	.....	.....
Autumn months.....	.....	.....	48.4	76.3	14.3	6.86	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT CEDAR RAPIDS, LINN COUNTY.

BY H. D. OLDS, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevalling wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			26.0	45.5	4	1.39	2.2	NW
February.....			23.6	62	-10	1.13	3.6	NW
March.....			28.1	53	-1	3.64	22.5	NE
April.....			51.8	79	20	1.63	0.8	SE
May.....			57.5	82	33	4.11		S
June.....			69.9	93	44	3.21		S
July.....			70.1	92	45	3.20		S
August.....			69.8	95	42	5.44		S
September.....			67.6	90	41	1.81		S
October.....			49.1	84	28	2.44		NW
November.....			31.5	60	-12	2.98	3.5	N
December.....			32.8	55	2	1.77	2.0	S
Sums.....			577.8	890.5	232	33.25	34.6	.....
Averages.....			48.2	74.2	19.4	2.77		.....
RECAPITULATION BY SEASONS—								
Winter months.....			27.5	54.2	-1.3	4.79		.....
Spring months.....			45.8	71.3	17.3	9.38		.....
Summer months.....			69.9	93.3	43.7	11.85		.....
Autumn months.....			49.4	78.0	19.0	7.23		.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT CLARINDA, PAGE COUNTY.

BY A. S. VAN SANDT, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevalling wind direction.
	Corrected for temperature only,	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			27.0	49.0	7	2.28	7.5	S
February.....			22.4	54.0	-10	1.10	6.5	S
March.....			29.4	61.0	3	1.89	17.0	NW
April.....			54.1	84	20	4.17	2.0	SE
May.....			59.2	84	37	3.19		S
June.....			70.0	91	51	6.18		S
July.....			70.6	87	51	3.50		S
August.....			71.4	93	44	4.67		S
September.....			69.2	90	40	2.0		S
October.....			52.4	81	29	2.78		NW
November.....			34.4	69	2	1.20	8.0	S
December.....			34.8	60	4	2.27	2.5	S
Sums.....			594.9	90.3	27.2	33.41	43.5	.....
Averages.....			49.6	75.2	22.7	2.78		.....
RECAPITULATION BY SEASONS—								
Winter months.....			28.1	54.3	3	5.63		.....
Spring months.....			47.6	76.3	18.0	9.25		.....
Summer months.....			70.7	90.3	48.7	14.35		.....
Autumn months.....			52.0	80.0	23.7	4.18		.....

ANNUAL REPORT OF THE  
ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CHARLES CITY, FLOYD COUNTY.

BY J. W. SMITH, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	.....	.....	.....	.....	.....	.....
February.....	.....	.....	14.0	58	-18	1.38	10.0	.....
March.....	.....	.....	27.4	50	6	1.86	13.1	.....
April.....	.....	.....	44.0	.....	19	1.75	T	.....
May.....	.....	.....	53.0	82	30	1.87	.....	.....
June.....	.....	.....	67.9	89	46	4.13	.....	.....
July.....	.....	.....	.....	.....	.....	3.18	.....	.....
August.....	.....	.....	.....	.....	.....	4.36	.....	.....
September.....	.....	.....	66.5	97	37	1.10	.....	.....
October.....	.....	.....	51.5	85	25	2.00	.....	.....
November.....	.....	.....	26.9	62	-18	1.40	6.0	.....
December.....	.....	.....	27.9	50	4	3.59	4.5	.....
Sums.....	.....	.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	.....	.....	.....	.....	.....	.....
Spring months.....	.....	.....	41.5	.....	14.3	5.48	.....	.....
Summer months.....	.....	.....	.....	.....	.....	11.67	.....	.....
Autumn months.....	.....	.....	48.3	8.13	14.7	4.50	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CLINTON, CLINTON COUNTY.

BY LUKE ROBERTS, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	.....	.....	.....	.....	.....	.....
February.....	.....	.....	.....	.....	.....	.....	.....	.....
March.....	.....	.....	.....	.....	.....	.....	.....	.....
April.....	.....	.....	.....	.....	.....	.....	.....	.....
May.....	.....	.....	58.7	82	31	3.57	.....	NE
June.....	.....	.....	70.4	94	47	3.11	.....	NE
July.....	.....	.....	68.8	91	43	4.14	.....	S
August.....	.....	.....	68.8	96	42	3.89	.....	S
September.....	.....	.....	66.3	92	40	1.68	.....	SW
October.....	.....	.....	49.7	88	26	1.46	.....	SW
November.....	.....	.....	31.2	57	-18	2.81	6.0	W
December.....	.....	.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	.....	.....	.....	.....	.....	.....
Spring months.....	.....	.....	.....	.....	.....	.....	.....	.....
Summer months.....	.....	.....	69.3	93.7	44	11.14	.....	.....
Autumn months.....	.....	.....	49.1	79.0	16	4.95	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
COLLEGE SPRINGS, PAGE COUNTY.

BY A. A. BERRY, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....								
February.....								
March.....								
April.....								
May.....						8.80		
June.....			68.2	91	50	8.72		
July.....			72.0	96	58	5.98		
August.....			70.6	96	49	5.74		
September.....			68.4	94	46	.41		
October.....			57.0	88	40	2.76	T	
November.....						1.03		
December.....			37.6	62	3	2.78	1.2	
Sums.....								
Averages.....								
RECAPITULATION BY SEASONS—								
Winter months.....								
Spring months.....								
Summer months.....			70.3	94.8	52.3	20.44		
Autumn months.....						4.20		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DELAWARE, DELAWARE COUNTY.

BY WM. BALL, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....								
February.....								
March.....								
April.....								
May.....			55.1		33	2.68		
June.....			66.4		48	3.12		
July.....			68.8	88	50	3.64		SE
August.....			65.7	96	40	5.68		
September.....			64.0	93	39	1.01		
October.....			46.0			2.83		
November.....			29.0		-19	2.89		
December.....			28.8	64	2	2.51	1.3	
Sums.....								
Averages.....								
RECAPITULATION BY SEASONS—								
Winter months.....								
Spring months.....								
Summer months.....			65.3		46.0	12.42		
Autumn months.....			46.3			6.58		



ANNUAL REPORT OF THE  
ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CRESCO, HOWARD COUNTY.

BY GREGORY MARSHALL, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	22.4	45	1	1.80	11.0	.....
February.....	.....	.....	12.6	43	-31	1.49	8.0	NW
March.....	.....	.....	23.3	45	- 7	1.68	12.0	NE
April.....	.....	.....	46.7	79	17	2.38	0.5	NW
May.....	.....	.....	56.1	83	27	1.58	....	SW
June.....	.....	.....	65.4	88	43	5.09	....	NE
July.....	.....	.....	65.1	85	45	4.15	....	NW
August.....	.....	.....	65.8	95	38	2.63	....	NW
September.....	.....	.....	65.5	91	36	.99	....	SW
October.....	.....	.....	47.8	76	22	1.95	....	NW
November.....	.....	.....	26.5	58	-12	1.01	0.5	NW
December.....	.....	.....	28.3	51	- 7	3.44	3.0	S
Sums.....	.....	.....	525.5	869	172	28.19	35.0	.....
Averages.....	.....	.....	43.8	69.9	14.3	2.35	....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	21.1	46.3	-12.3	6.73	....	.....
Spring months.....	.....	.....	42.0	69.0	12.3	5.64	....	.....
Summer months.....	.....	.....	65.4	89.3	42.0	11.87	....	.....
Autumn months.....	.....	.....	46.6	75.0	15.3	3.95	....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DAVENPORT, SCOTT COUNTY.

BY F. J. WALTZ, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	27.8	44	3	2.38	0	SW
February.....	.....	.....	26.4	66	- 8	.89	....	NW
March.....	.....	.....	28.8	58	1	1.78	....	NE
April.....	.....	.....	51.8	77	21	3.30	....	NW
May.....	.....	.....	58.3	80	35	2.74	....	NE
June.....	.....	.....	70.6	92	49	3.56	....	E
July.....	.....	.....	69.2	87	49	3.29	....	.....
August.....	.....	.....	70.0	94	46	6.54	....	SW
September.....	.....	.....	69.7	91	44	1.50	....	SW
October.....	.....	.....	53.1	87	31	1.37	....	SW
November.....	.....	.....	32.5	58	-10	3.56	....	W
December.....	.....	.....	34.8	57	5	1.64	....	SW
Sums.....	.....	.....	593.0	891	266	31.45	....	.....
Averages.....	.....	.....	49.4	74.2	22.2	2.62	....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	29.7	55.7	0	4.91	....	.....
Spring months.....	.....	.....	46.3	71.7	19.0	7.72	....	.....
Summer months.....	.....	.....	69.9	91.0	48.0	12.39	....	.....
Autumn months.....	.....	.....	51.8	78.7	21.7	6.43	....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DES MOINES, POLK COUNTY.

BY GEO. M. CHAPPEL, M. D., VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	28.3	47	6	1.82	4.0	NW
February.....	.....	.....	28.2	55	-10	1.13	8.9	W
March.....	.....	.....	28.6	60	-5	2.28	17.5	NE
April.....	.....	.....	52.0	81	20	2.12	1	S
May.....	.....	.....	57.8	83	34	3.20	.....	NE
June.....	.....	.....	60.2	90	40	5.60	.....	S
July.....	.....	.....	68.1	88	49	2.79	.....	NW
August.....	.....	.....	66.8	93	40	4.22	.....	SW
September.....	.....	.....	68.2	90	30	1.64	.....	S
October.....	.....	.....	62.2	81	28	2.41	.....	NW
November.....	.....	.....	32.0	66	-10	1.34	3.3	NW
December.....	.....	.....	34.6	61	0	1.54	8.3	SW
Sums.....	.....	.....	584.2	905	240	30.14	114.0	.....
Averages.....	.....	.....	48.7	74.6	20.0	2.51	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	28.7	54.3	-1.3	4.49	.....	.....
Spring months.....	.....	.....	46.2	74.7	16.3	7.68	.....	.....
Summer months.....	.....	.....	60.0	90.3	40.0	12.00	.....	.....
Autumn months.....	.....	.....	50.5	70.0	19.0	5.30	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DUBUQUE, DUBUQUE COUNTY.

BY S. C. EMERY, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	26.8	46	4	1.27	.....	NW
February.....	.....	.....	23.1	61	-13	2.98	.....	NW
March.....	.....	.....	27.7	64	-1	2.69	.....	NE
April.....	.....	.....	50.8	78	20	1.63	.....	W
May.....	.....	.....	58.2	82	36	2.54	.....	NE
June.....	.....	.....	69.8	92	47	2.34	.....	E
July.....	.....	.....	68.8	89	49	4.50	.....	ENW
August.....	.....	.....	70.2	96	48	3.31	.....	NW
September.....	.....	.....	69.3	94	40	.68	.....	S
October.....	.....	.....	60.8	87	20	2.20	.....	NW
November.....	.....	.....	31.0	67	-7	3.24	.....	NW
December.....	.....	.....	33.0	64	1	2.08	.....	S
Sums.....	.....	.....	579.5	800	261	27.55	.....	.....
Averages.....	.....	.....	48.3	74.2	20.8	2.30	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	27.6	53.7	-3.7	4.38	.....	.....
Spring months.....	.....	.....	45.6	71.3	18.3	6.86	.....	.....
Summer months.....	.....	.....	69.6	92.3	47.0	10.24	.....	.....
Autumn months.....	.....	.....	60.4	79.2	20.7	6.12	.....	.....

ANNUAL REPORT OF THE  
ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
EAGLE GROVE, WRIGHT COUNTY.

BY C. A. SCHAFFTER, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	20.2	38	-4	2.75	3.0	NW
February.....	.....	.....	9.4	15	-20	0.00	2.0	SE
March.....	.....	.....	23.4	35	-9	1.90	16.0	SS
April.....	.....	.....	48.0	55	20	2.80	.....	SS
May.....	.....	.....	58.5	65	34	2.40	.....	SS
June.....	.....	.....	60.0	72	64	8.65	.....	SS
July.....	.....	.....	69.8	77	52	5.60	.....	NW
August.....	.....	.....	70.2	80	44	3.35	.....	SE
September.....	.....	.....	65.5	74	57	3.60	.....	E
October.....	.....	.....	43.0	50	38	4.00	.....	NE
November.....	.....	.....	24.6	30	-20	.80	2.0	NW
December.....	.....	.....	28.6	33	-6	3.93	1.8	NE
Sums.....	.....	.....	530.1	622	258	40.98	24.8	.....
Averages.....	.....	.....	44.2	51.8	21.5	3.42	.....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	19.4	28.0	-7.3	12.08	.....	.....
Spring months.....	.....	.....	43.3	51.7	15.0	7.10	.....	.....
Summer months.....	.....	.....	69.7	76.3	53.3	17.60	.....	.....
Autumn months.....	.....	.....	44.4	51.3	25.0	8.40	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
FAYETTE, FAYETTE COUNTY.

BY R. J. LATIMER, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	23.3	43.5	0	1.68	8.0	NW
February.....	.....	.....	18.8	50.0	-18	1.30	7.2	NW
March.....	.....	.....	25.5	50.0	-8	3.38	18.8	NE
April.....	.....	.....	47.4	71.1	18	2.22	0.5	NW
May.....	.....	.....	55.1	83	25	1.99	.....	SW
June.....	.....	.....	66.0	93	40	4.86	.....	SE
July.....	.....	.....	65.1	90	41	3.45	.....	NW
August.....	.....	.....	65.0	94	34	4.22	.....	SW
September.....	.....	.....	65.8	92	32	1.35	.....	SE
October.....	.....	.....	47.9	76	19	2.27	.....	NW
November.....	.....	.....	28.2	59	-20	2.61	.....	NW
December.....	.....	.....	30.5	53	-4	3.18	2.0	SW
Sums.....	.....	.....	538.6	864.5	159	32.60	36.5	.....
Averages.....	.....	.....	44.9	72.0	13.2	2.72	.....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	24.2	48.8	-7.3	6.25	.....	.....
Spring months.....	.....	.....	42.7	71.3	11.7	7.59	.....	.....
Summer months.....	.....	.....	65.4	92.3	38.3	12.53	.....	.....
Autumn months.....	.....	.....	47.3	75.7	10.3	6.23	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
FAIRFIELD, JEFFERSON COUNTY.

BY DR. J. FRED CLARKE, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....	.....	.....	.....	.....	.....	.....	.....	.....
February .....	.....	.....	.....	.....	.....	.....	.....	.....
March .....	.....	.....	.....	.....	.....	4.58	32.5	NE
April .....	.....	.....	1.9	81	22	2.18	0.3	NW
May .....	.....	.....	59.6	86	32	2.52	.....	NW
June .....	.....	.....	70.2	96	50	3.87	.....	NW
July .....	.....	.....	69.5	90	49	3.91	.....	NW
August .....	.....	.....	67.5	94	45	8.36	.....	NW
September .....	.....	.....	68.5	89	42	.51	.....	NW
October .....	.....	.....	.....	.....	.....	1.76	.....	.....
November .....	.....	.....	33.1	63	- 6	3.54	3.8	NW
December .....	.....	.....	34.3	56	4	1.93	9.5	S
Sums .....	.....	.....	.....	.....	.....	.....	.....	.....
Averages .....	.....	.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months .....	.....	.....	.....	.....	.....	.....	.....	.....
Spring months .....	.....	.....	.....	.....	.....	9.28	.....	.....
Summer months .....	.....	.....	69.1	93.3	48.0	16.14	.....	.....
Autumn months .....	.....	.....	.....	.....	.....	.....	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
FT. MADISON, LEE COUNTY.

BY MISS L. A. M'CREADY, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....	.....	.....	36.6	48	12	0.61	3.0	SW
February .....	.....	.....	29.6	60	- 4	1.35	1.0	SW
March .....	.....	.....	34.4	62	3	2.25	13.0	NE
April .....	.....	.....	55.9	78	23	2.50	.....	SW
May .....	.....	.....	63.2	83	40	1.86	.....	SW
June .....	.....	.....	71.2	95	54	5.72	.....	NE
July .....	.....	.....	73.6	94	55	3.25	.....	SW
August .....	.....	.....	74.6	98	50	?	.....	SW
September .....	.....	.....	73.9	100	49	.....	1.19	SW
October .....	.....	.....	56.1	90	35	1.76	.....	SW
November .....	.....	.....	37.0	59	2	2.36	.....	NW
December .....	.....	.....	39.1	58	6	1.73	8.5	SW
Sums .....	.....	.....	639.2	934	327	23.48	25.5	.....
Averages .....	.....	.....	53.3	77.8	27.2	19.6	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months .....	.....	.....	33.1	56.3	4.7	3.69	.....	.....
Spring months .....	.....	.....	51.2	74.3	22.7	6.70	.....	.....
Summer months .....	.....	.....	73.1	95.7	53.0	.....	.....	.....
Autumn months .....	.....	.....	55.7	83.0	28.7	.....	.....	.....

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ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GLENWOOD, MILLS COUNTY.

BY SETH DEAN, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....	.....	.....	28.2	50	5	2.35	5.0	NW
February.....	.....	.....	21.1	58	-14	.57	5.0	NW
March.....	.....	.....	29.7	68	- 8	1.44	10.8	NE
April.....	.....	.....	55.4	90	18	3.21	.....	NW
May.....	.....	.....	62.7	94	36	4.84	.....	S
June.....	.....	.....	72.5	98	52	6.07	.....	NE
July.....	.....	.....	72.8	96	50	5.26	.....	NW
August.....	.....	.....	75.4	106	42	2.58	.....	S
September.....	.....	.....	73.0	104	40	1.65	.....	S
October.....	.....	.....	56.4	89	28	4.81	.....	S
November.....	.....	.....	38.8	84	- 2	.06	2.0	NW
December.....	.....	.....	38.0	72	- 2	1.21	3.0	S
Sums.....	.....	.....	620.0	1007	245	34.03	25.8	.....
Averages .. ..	.....	.....	51.7	83.9	20.4	2.84	.....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	28.4	60.0	- 3.7	4.13	.....	.....
Spring months .....	.....	.....	49.3	83.3	15.3	9.49	.....	.....
Summer months.....	.....	.....	73.6	100	48.0	13.91	.....	.....
Autumn months.....	.....	.....	55.4	92.3	22.0	6.52	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GRAND MEADOW, CLAYTON COUNTY.

BY F. S. WILLIAMS, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January. . . . .	.....	.....	.....	.....	.....	.....	.....	.....
February.....	.....	.....	.....	.....	.....	.....	.....	.....
March.....	.....	.....	.....	.....	.....	.....	.....	.....
April. ....	.....	.....	48.5	78	15	1.63	.....	.....
May. . . . .	.....	.....	56.0	78	34	1.50	.....	.....
June... ..	.....	.....	65.9	90	46	5.34	.....	.....
July.....	.....	.....	65.5	84	50	3.67	.....	.....
August.....	.....	.....	65.9	92	44	2.52	.....	.....
September...	.....	.....	65.4	90	42	1.42	.....	.....
October . . .	.....	.....	48.3	74	27	2.02	.....	.....
November.....	.....	.....	29.2	56	- 7	1.44	2.2	.....
December.....	.....	.....	31.0	52	- 2	4.01	1.2	.....
Sums .....	.....	.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—								
Winter months.....	.....	.....	.....	.....	.....	.....	.....	.....
Spring months.....	.....	.....	.....	.....	.....	.....	.....	.....
Summer months .....	.....	.....	65.8	88.7	46.7	11.57	.....	.....
Autumn months.....	.....	.....	47.6	73.3	20.7	4.88	.....	.....

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT GRINNELL, POWESHIEK COUNTY.

BY PROF. S. J BLACK, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	24.9	42	8	0.88	.....	NNE
February.....	.....	.....	21.8	54	-12	.60	.....	NW
March.....	.....	.....	26.0	52	-4	2.29	.....	NNE
April.....	.....	.....	50.3	76	22	1.65	.....	NW
May.....	.....	.....	57.9	78	34	3.44	.....	NNE
June.....	.....	.....	68.0	88	48	7.15	.....	ENE
July.....	.....	.....	67.8	88	44	2.55	.....	ENE
August.....	.....	.....	68.4	93	40	5.04	.....	ENE
September.....	.....	.....	68.8	88	38	1.28	.....	ENE
October.....	.....	.....	52.2	71	28	2.34	.....	NW
November.....	.....	.....	31.4	59	-10	1.18	.....	NW
December.....	.....	.....	33.0	54	-1	1.52	T	S
Sums.....	.....	.....	570.5	843	230	29.92	.....	.....
Averages.....	.....	.....	47.5	70.2	19.2	2.49	.....	.....
RECAPITULATION BY SEASONS—								
Winter months..	.....	.....	26.6	50.0	-3.3	3.00	.....	.....
Spring months..	.....	.....	44.7	68.7	17.3	7.38	.....	.....
Summer months..	.....	.....	68.1	89.7	43.0	14.74	.....	.....
Autumn months..	.....	.....	50.8	72.7	18.7	4.80	.....	.....

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT GREENFIELD, ADAIR COUNTY.

BY J. G. CULVER, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	25.8	47.0	3.9	2.22	9.8	SW
February.....	.....	.....	20.4	54	-14	1.65	8.3	W
March.....	.....	.....	27.3	59	-8	2.83	19.9	W
April.....	.....	.....	51.3	84	18	2.28	.....	SW
May.....	.....	.....	58.1	85	32	2.98	.....	SW
June.....	.....	.....	68.0	90	41	9.61	.....	W
July.....	.....	.....	67.8	88	49	5.60	.....	SW
August.....	.....	.....	68.6	91	38	1.66	.....	SW
September.....	.....	.....	67.7	90	36	.92	.....	SW
October.....	.....	.....	50.0	80	26	2.27	T	W
November.....	.....	.....	30.5	55	-8	1.38	6.8	NW
December.....	.....	.....	32.0	59	-2	2.75	6.4	NW
Sums...	.....	.....	567.5	880	211.9	36.15	51.2	.....
Averages.....	.....	.....	47.3	73.3	17.7	3.01	.....	.....
RECAPITULATION BY SEASONS—								
Winter months..	.....	.....	26.1	53.3	-4.0	6.62	.....	.....
Spring months..	.....	.....	45.6	76.0	14.0	8.09	.....	.....
Summer months..	.....	.....	66.1	89.0	42.7	16.87	.....	.....
Autumn months..	.....	.....	49.4	75.0	18.0	4.57	.....	.....

## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GRUNDY CENTER, GRUNDY COUNTY.

BY CHARLES G. ROGERS, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	.....	.....	.....	.....	.....	.....
February.....	.....	.....	.....	.....	.....	.....	.....	.....
March.....	.....	.....	.....	.....	.....	.....	.....	.....
April.....	.....	.....	52.8	80	21	2.93	T	.....
May.....	.....	.....	57.8	81	36	2.29	.....	.....
June.....	.....	.....	66.1	92	49	2.73	.....	.....
July.....	.....	.....	68.5	99	54	4.09	.....	.....
August.....	.....	.....	68.3	93	47	4.34	.....	.....
September.....	.....	.....	66.8	90	42	1.82	.....	.....
October.....	.....	.....	48.9	78	27	2.75	.....	.....
November.....	.....	.....	29.9	57	-11	1.30	3.5	.....
December.....	.....	.....	31.7	54	-4	2.33	1.0	.....
Sums.....	.....	.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	.....	.....	.....	.....	.....	.....
Spring months.....	.....	.....	.....	.....	.....	.....	.....	.....
Summer months.....	.....	.....	68.3	91.7	50.0	11.16	.....	.....
Autumn months.....	.....	.....	48.5	75.0	19.3	5.87	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
HAMPTON, FRANKLIN COUNTY.

BY E. C. GRENELLE, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	21.8	47	-8	2.70	6.2	NW
February.....	.....	.....	13.0	44	-18	1.62	14.8	NW
March.....	.....	.....	22.9	49	-6	3.76	20.0	NE
April.....	.....	.....	47.2	83	17	1.67	.....	NW
May.....	.....	.....	55.7	82	28	2.06	.....	SW
June.....	.....	.....	68.0	90	37	4.41	.....	SE
July.....	.....	.....	66.0	87	45	6.55	.....	NW
August.....	.....	.....	65.9	93	38	3.08	.....	NW
September.....	.....	.....	64.5	89	37	3.34	.....	SW
October.....	.....	.....	48.3	77	24	2.69	.....	NW
November.....	.....	.....	26.9	59	-15	1.19	2.5	NW
December.....	.....	.....	28.8	52	-7	2.88	3.0	SE
Sums.....	.....	.....	527.0	852	177	36.15	55.5	.....
Averages.....	.....	.....	43.9	71.0	14.8	3.01	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	21.2	47.7	-9.3	7.20	.....	.....
Spring months.....	.....	.....	41.9	71.3	13.0	7.49	.....	.....
Summer months.....	.....	.....	66.0	90.0	40.0	14.04	.....	.....
Autumn months.....	.....	.....	46.6	75.0	15.3	7.42	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
HOPEVILLE, CLARKE COUNTY.

BY W. E. ASHLEY, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.						
January.....			26.4	50	- 8	2.34	...	NNW
February.....			23.4	50	- 8	2.87	4.6	NNW
March.....			29.0	60	- 4	2.50	15.5	NNW
April.....			52.2	80	21	2.72	...	NNW
May.....			59.5	82	41	2.93	...	NNW
June.....			66.7	80	50	6.14	8	SSW
July.....			68.7	90	53	5.53	...	NW
August.....			68.9	92	41	3.75	...	SSW
September.....			67.0	90	30	1.13	...	SSW
October.....			50.5	81	28	2.14	...	NW
November.....			30.9	66	- 5	1.05	8.0	NW
December.....			32.7	58	1	1.49	4.0	S
Sums.....			576.9			32.50	27.1	...
Averages.....			48.1			2.72		...
RECAPITULATION BY SEASONS—								
Winter months.....			27.5			4.70		
Spring months.....			46.6	74.0	10.3	9.15		
Summer months.....			68.8	90.3	48.0	16.42		
Autumn months.....			49.5	70.0	20.7	3.32		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
HOPKINTON, DELAWARE COUNTY.

BY T. MARKS, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			27.0	44	10	1.60	4.0	NW
February.....			24.0	60	- 12	1.08	4.0	NW
March.....			29.0	60	- 1	2.62	2.3	NW
April.....			51.0	77	19	2.45	1.0	NW
May.....			58.0	82	34	2.70	...	SW
June.....			69.0	90	46	1.68	...	...
July.....			70.0	89	46	3.41	...	SE
August.....			70.0	92	43	5.83	...	NW
September.....			68.8	90	42	1.90	...	SW
October.....			48.0	82	30	2.55	...	NW
November.....			32.0	56	- 10	3.42	5.0	NW
December.....			36.0	52	5	2.65	4.0	SE
Sums.....			582.8	865	254	30.79	20.3	...
Averages.....			48.6	72.1	21.2	2.56		...
RECAPITULATION BY SEASONS—								
Winter months.....			29.0	52.3	1.0	5.33		
Spring months.....			46.0	69.7	17.8	7.67		
Summer months.....			69.7	90.3	45.7	10.92		
Autumn months.....			49.8	76.0	20.7	8.67		



# ANNUAL REPORT OF THE

## ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT INDEPENDENCE, BUCHANAN COUNTY.

BY E. F. WULFKE, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	25.6	41.0	1	1.54	5.9	SW
February.....	.....	.....	20.0	46.0	-11	.79	5.9	W
March.....	.....	.....	27.2	48.0	-4	2.30	19.5	NE
April.....	.....	.....	50.2	75	23	2.17	0.2	SE
May.....	.....	.....	58.0	76	37	3.32	.....	SW
June.....	.....	.....	68.1	86	49	2.06	.....	E
July.....	.....	.....	68.4	85	55	3.84	.....	NW
August.....	.....	.....	67.9	90	48	4.35	.....	NW
September.....	.....	.....	66.1	86	47	1.23	.....	S
October.....	.....	.....	48.9	73	30	2.78	.....	NW
November.....	.....	.....	29.5	53	-15	1.37	2.6	W
December.....	.....	.....	31.7	51	2	2.38	1.1	S
Sums.....	.....	.....	561.6	810	262	28.13	35.4	.....
Averages.....	.....	.....	46.8	67.5	21.8	2.34	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	25.8	46.0	-2.7	4.71	.....	.....
Spring months.....	.....	.....	45.1	66.3	18.7	7.79	.....	.....
Summer months.....	.....	.....	68.1	87.0	50.7	10.25	.....	.....
Autumn months.....	.....	.....	48.2	70.7	20.7	5.38	.....	.....

## ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT IOWA CITY, JOHNSON COUNTY.

BY PROF. A. A. VEBLEN, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	28.6	48	3	1.49	3.0	NW
February.....	.....	.....	26.7	63	-9	1.30	7.0	NW
March.....	.....	.....	33.3	52	-3	4.41	19.0	NE
April.....	.....	.....	51.7	73	21	1.11	1.0	SE
May.....	.....	.....	58.6	72	33	4.46	.....	NW
June.....	.....	.....	71.6	92	48	2.80	.....	S
July.....	.....	.....	69.2	89	46	3.01	.....	S
August.....	.....	.....	68.4	95	-41	3.45	.....	S
September.....	.....	.....	66.3	92	40	2.33	.....	W
October.....	.....	.....	50.4	88	27	1.63	.....	NW
November.....	.....	.....	31.9	60	-10	2.93	4.0	NW
December.....	.....	.....	32.9	55	-2	2.72	8.0	SE
Sums.....	.....	.....	584.6	894	235	31.64	42.0	.....
Average.....	.....	.....	48.7	74.5	19.6	2.64	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	29.4	55.3	-2.7	5.51	.....	.....
Spring months.....	.....	.....	46.2	70.7	17.0	9.98	.....	.....
Summer months.....	.....	.....	69.7	92.0	45.0	9.26	.....	.....
Autumn months.....	.....	.....	49.5	80.0	19.0	6.89	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
KEOKUK, LEE COUNTY.

BY F. Z. GOZEWISCH, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January..			31.6	55	6	2.50		SW
February			29.2	70	- 6	1.32		NW
March			31.1	65	- 1	2.27		NW
April			54.0	80	22	5.06		NW
May			60.5	85	36	2.56		E
June			71.5	94	49	3.66		SE
July			70.6	89	52	2.77		NW
August			71.1	95	47	6.10		SW
September			70.9	92	45	.49		SW
October			54.5	80	33	1.49		NW
November			35.5	68	- 1	3.60		NW
December			37.9	62	6	1.33		S
Sums			618.4	944	288	33.24		
Averages			51.5	78.7	24.0	2.77		
RECAPITULATION BY SEASONS—								
Winter months			32.9	62.3	2.0	5.24		
Spring months			48.5	76.7	19.0	9.89		
Summer months			71.1	92.7	49.3	12.53		
Autumn months			53.6	83.0	25.7	5.58		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
LARRABEE, CHEROKEE COUNTY.

BY H. B. STREVER, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January			...	...	...	1.31	12.5	
February			8.4	42	-23	1.07	10.0	
March			23.8	46	-19	1.54	11.9	
April			48.9	85	14	1.23	T	
May			57.0	88	34	2.73	T	
June			65.9	92	46	19.89		
July			67.1	90	52	8.20		
August			66.8	93	40	3.85		
September			65.3	84	32	1.82		
October			45.4	76	21	3.38	T	
November			26.1	63	-24	.67	4.4	
December			27.0	50	-14	2.93	3.0	
Sums						48.61	41.8	
Averages						4.05		
RECAPITULATION BY SEASONS—								
Winter months						5.31		
Spring months			43.2	73.0	9.7	5.50		
Summer months			66.6	91.7	46.0	31.93		
Autumn months			45.6	77.7	9.7	5.87		

## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
LOGAN, HARRISON COUNTY.

BY MRS. M. B. STERN, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....	.....	.....	30.2	50	5	1.79	9.5	.....
February .....	.....	.....	18.7	53	-15	1.60	16.0	.....
March .....	.....	.....	29.9	60	-7	2.33	14.0	.....
April .....	.....	.....	55.2	86	18	2.10	.....	.....
May .....	.....	.....	61.2	87	35	3.93	.....	.....
June .....	.....	.....	70.2	93	48	3.47	.....	.....
July .....	.....	.....	71.7	90	46	6.16	.....	.....
August .....	.....	.....	72.1	95	40	3.31	.....	.....
September .....	.....	.....	69.8	91	35	1.74	.....	.....
October .....	.....	.....	50.7	77	26	5.64	.....	.....
November .....	.....	.....	34.7	67	-3	.60	5.5	.....
December .....	.....	.....	34.6	60	-2	2.72	7.0	.....
Sums .....	.....	.....	599.0	909	223	35.39	52.0	.....
Averages .....	.....	.....	49.9	75.8	18.6	2.95	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months .....	.....	.....	27.8	54.3	-4.0	6.11	.....	.....
Spring months .....	.....	.....	48.8	77.7	15.3	8.36	.....	.....
Summer months .....	.....	.....	71.3	92.7	44.7	12.94	.....	.....
Autumn months .....	.....	.....	51.7	78.3	19.3	7.98	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MAXON, MONROE COUNTY.

BY GEORGE PRICE, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....	.....	.....	.....	.....	.....	.....	.....	.....
February .....	.....	.....	.....	.....	.....	.....	.....	.....
March .....	.....	.....	.....	.....	.....	.....	.....	.....
April .....	.....	.....	52.5	80	21	3.05	T	.....
May .....	.....	.....	61.0	83	36	4.06	.....	.....
June .....	.....	.....	69.1	92	47	3.49	.....	.....
July .....	.....	.....	68.9	89	55	3.69	.....	.....
August .....	.....	.....	71.2	94	48	13.02	.....	.....
September .....	.....	.....	69.3	91	44	.51	.....	.....
October .....	.....	.....	49.0	83	34	1.62	.....	.....
November .....	.....	.....	33.4	62	-10	3.30	.....	.....
December .....	.....	.....	31.1	58	0	2.41	.....	.....
Sums .....	.....	.....	.....	.....	.....	.....	.....	.....
Averages .....	.....	.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months .....	.....	.....	.....	.....	.....	.....	.....	.....
Spring months .....	.....	.....	.....	.....	.....	.....	.....	.....
Summer months .....	.....	.....	67.9	91.7	50.0	20.20	.....	.....
Autumn months .....	.....	.....	50.6	78.7	22.7	5.43	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MARSHALLTOWN, MARSHALL COUNTY.

BY CHAS. R. BROWN, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....			16.2	38	-15	1.09	6.6	
February .....			28.9	58	-7	3.35	18.8	
March .....			50.1	80	20	1.68	7	
April .....			58.9	83	27	2.08		
May .....			69.5	91	45	4.49		
June .....			68.0	88	44	4.00		
July .....			68.5	94	38	3.61		
August .....			66.4	90	38	.98		
September .....			49.5	81	24	2.80		
October .....								
November .....								
December .....			30.5	55	-2	2.50	1.5	
Sums .....								
Averages .....								
RECAPITULATION BY SEASONS—								
Winter months .....								
Spring months .....			44.6	72.7	13.3	7.09		
Summer months .....			68.7	91.3	42.3	12.10		
Autumn months .....								

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
McCAUSLAND, SCOTT COUNTY.

BY MISS RUBY PEARL BARR, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....			27.0	40	5	3.99	3.8	
February .....			27.0	63	-2	1.29	2.0	
March .....								
April .....			50.0	78	22	3.27		
May .....			55.5	78	37	3.26		
June .....			67.2	84	46	3.21		
July .....			65.6	82	52	3.10		
August .....			66.1	89	46	4.08		
September .....			64.7	87	41	1.44		
October .....			49.5	84	28	.85		
November .....			31.3	53	-12	2.97	8.5	
December .....			32.1	54	4	1.83	6.5	
Sums .....							21.8	
Averages .....								
RECAPITULATION BY SEASONS—								
Winter months .....			28.7	52.0	2.3	7.11		
Spring months .....								
Summer months .....			66.3	85.0	48.0	10.39		
Autumn months .....			48.5	74.7	19.0	5.26		

ANNUAL REPORT OF THE  
ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MURRAY, CLARK COUNTY.

BY A. W. LEWIS, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....								
February.....								
March.....								
April.....			80	89		2.58	F	
May.....			58.2	81	36	3.77		
June.....			67.9	88	48	6.31		
July.....			68.3	88	48	7.12		
August.....			69.6	90	41	2.56		
September.....			59.0	90	40	.26		
October.....			50.4	79	27	2.01		NW
November.....			50.8	68	- 4	.88		
December.....			53.6	58	4	1.49		S
Sums.....								
Average.....								
RECAPITULATION OF SEASONS—								
Winter months.....								
Spring months.....								
Summer months.....			68.6	88.3	45.7	15.99		
Autumn months.....			49.7	78.3	21.0	3.15		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MUSCATINE, MUSCATINE COUNTY.

BY J. P. WALTON, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			24.5	50	- 3	1.75	3.8	
February.....			25.9	58	- 5	1.29	4.0	
March.....			29.0	57	- 2	3.50	28.0	NE
April.....			46.4	79	21	2.61		
May.....			58.6	83	34	2.51		
June.....			72.4	91	48	4.87		
July.....			68.8	90	45	3.29		
August.....			58.6	90	44	5.20		
September.....			66.4	90	40	1.35		
October.....			52.0	88	28	1.49		
November.....			32.5	68	-13	3.60	3.0	
December.....			33.8	56	5	2.51	8.5	
Sums.....			569.1	900	248	34.17	47.3	
Averages.....			47.4	75.0	20.7	2.85		
RECAPITULATION BY SEASONS—								
Winter months.....			28.1	54.7	1.0	5.55		
Spring months.....			44.7	73.0	17.7	8.62		
Summer months.....			66.9	90.3	45.7	13.36		
Autumn months.....			50.3	82.0	18.3	6.54		

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT MONTICELLO, JONES COUNTY.

BY HENRY D. SCHMIDT, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....	.....	.....	25.7	44	6	1.25	2.3	NW
February .....	.....	.....	21.6	38	-15	.88	8.7	NW
March .....	.....	.....	27.0	50	-5	2.55	20.5	NE
April .....	.....	.....	50.0	29.8	42	2.00	0.1	NW
May .....	.....	.....	58.0	83	31	2.70	..	S
June .....	.....	.....	69.8	95	46	1.92	....	S
July .....	.....	.....	68.4	91	46	4.55	....	NW
August .....	.....	.....	68.1	93	48	4.11	....	S
September .....	.....	.....	65.5	90	39	.64	....	S
October .....	.....	.....	48.8	87	23	2.16	3.4	NW
November .....	.....	.....	29.9	57	-16	2.55	2.0	NW
December .....	.....	.....	31.3	54	4	2.09	14.0	S
Sums .....	.....	.....	564.1	831.8	249	27.38	....	.....
Averages .....	.....	.....	47.0	69.3	20.9	2.28	....	.....
RECAPITULATION BY SEASONS—								
Winter months .....	.....	.....	26.2	52.0	-1.7	4.20	....	....
Spring months .....	.....	.....	45.0	54.3	22.7	7.25	....	....
Summer months .....	.....	.....	68.8	93.0	46.7	10.58	....	....
Autumn months .....	.....	.....	48.1	78.0	15.3	5.35	....	....

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT OSAGE, MITCHELL COUNTY.

BY G. D. PATTINGILL, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....	.....	.....	21.3	39.2	4	1.90	16.0	....
February .....	.....	.....	11.5	41	-22	1.37	9.5	....
March .....	.....	.....	23.2	40	-6	1.47	....	....
April .....	.....	.....	46.3	.....	19	2.06	....	....
May .....	.....	.....	54.7	.....	34	1.75	....	....
June .....	.....	.....	65.4	.....	.....	3.16	....	....
July .....	.....	.....	64.5	.....	51	2.58	....	....
August .....	.....	.....	64.3	85	42	2.05	....	....
September .....	.....	.....	61.4	.....	38	1.68	....	....
October .....	.....	.....	44.1	.....	23	3.09	....	....
November .....	.....	.....	24.8	.....	-16	.53	1.5	....
December .....	.....	.....	27.2	.....	5	3.15	6.0	....
Sums .....	.....	.....	506.2	.....	.....	24.79	33.0	....
Averages .....	.....	.....	42.4	.....	.....	2.07	....	....
RECAPITULATION BY SEASONS—								
Winter months .....	.....	.....	20.0	.....	-7.7	6.42	....	....
Spring months .....	.....	.....	41.4	.....	15.7	5.28	....	....
Summer months .....	.....	.....	64.9	.....	.....	7.79	....	....
Autumn months .....	.....	.....	43.4	.....	15.0	5.30	....	....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
OMAHA, NEBRASKA.

BY L. A. WELSH, VOLUNTARY OBSERVER.

							rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
January.....			29.6	56	8		2.11	...	NW
February.....			19.7	52	- 9		1.02	...	NW
March.....			28.6	62	- 6		2.26	...	NW
April.....			52.9	90	17		2.86	...	NW
May.....			60.3	83	28		4.94	...	S
June.....			60.4	92	46		6.66	...	S
July.....			71.2	90	51		2.54	...	SE
August.....			72.3	97	44		2.02	...	SE
September.....			60.9	91	43		1.76	...	...
October ..			52.0	84	31		5.37	...	NW
November.....			34.2	68	- 2		.87	...	NW
December..			34.8	60	2		2.07	...	S
Sums.....			505.8	926	263		34.92	...	...
Averages ..			49.6	77.2	31.9		2.91	...	...
RECAPITULATION BY SEASONS—									
Winter months ..			28.0	56.3	.3		5.30	...	...
Spring months.....			47.8	78.3	16.3		10.00	...	...
Summer months ..			71.0	89.0	47.0		12.22	...	...
Autumn months ..			52.4	81.0	24.0		7.50	...	...

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
OSKALOOSA, MAHASKA COUNTY.

BY JOSEPH BOYD, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			30	51	23	2.3	2.3	NW
February.....			24	46	18	2.8	2.8	NW
March.....			22	42	17	17.3	17.3	NE
April.....			33	53	14	T	T	NW
May.....			60	80	46	...	...	SW
June.....			70	90	50	...	...	E
July.....			66	86	46	...	...	SW
August.....			70	90	50	...	...	NW
September.....			68	88	48	...	...	SW
October.....			61	81	41	...	...	NW
November.....			38	58	18	2.0	2.0	NW
December.....			36	56	16	4.8	4.8	SW
Sums.....			606	806	506	30.7	30.7	..
Averages ..			49	69	39	...	...	...
RECAPITULATION BY SEASONS—								
Winter months.....			30	50	20	...	...	...
Spring months.....			47	67	37	...	...	...
Summer months.....			66	86	46	...	...	...
Autumn months.....			51	71	31	...	...	...

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
PANAMA, SHELBY COUNTY.

BY WM. J. WICKS, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			28.1	53.8	3	1.34	3.9	NW
February.....			19.4	50	-11	.87	5.5	NW
March.....			27.6	60	-9	1.46	3.6	NW
April.....			50.0	66	18	2.25	...	NW
May.....			55.5	84	33	2.57	...	NE
June.....			67.9	90	46	4.50	...	SW
July.....			68.9	90	46	6.97	...	S
August.....			69.4	92	40	3.90	...	S
September.....			67.2	89	35	2.81	...	S
October.....			46.3	80	26	6.53	...	NW
November.....			28.2	66	-6	.54	4.5	NW
December.....			31.8	54	-4	2.79	2.1	S
Sums.....			551.3	894.8	217	36.58	27.8	.....
Averages.....			46.8	74.6	18.0	3.05	...	.....
RECAPITULATION BY SEASONS—								
Winter months.....			26.4	52.6	-4.0	5.00	...	.....
Spring months.....			44.7	76.7	14.0	6.28	...	.....
Summer months.....			68.7	90.7	44.0	15.37	...	.....
Autumn months.....			47.2	78.3	18.3	9.93	...	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
STILSON, HANCOCK COUNTY.

BY WM. WARD, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			12.6	41	-24	.55	7.1	NW
February.....			32.8	50	-9	1.40	15.0	NW
March.....			48.4	67	16	1.80	...	SW
April.....			57.0	74	26	2.00	...	SW
May.....			69.5	98	40	7.90	...	SE
June.....			69.0	99	43	3.85	...	SE
July.....			70.0	98	40	2.25	...	SE
August.....			66.3	90	33	2.60	...	SE
September.....			48.4	79	20	3.41	...	...
October.....								...
November.....								...
December.....								...
Sums.....								...
Averages.....								...
RECAPITULATION BY SEASONS—								
Winter months.....								...
Spring months.....			42.7	73.7	11.0	5.20	...	...
Summer months.....			69.5	97.7	41.0	14.00	...	...
Autumn months.....								...



# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT RICHLAND, KEOKUK COUNTY.

BY WM. A. SHAFFER, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....								
February.....								
March.....								
April.....			50.2		24	2.19	0.2	
May.....			58.4		39	2.11		
June.....			68.6			3.72		
July.....			67.6		52	3.30		
August.....			67.4			5.67		
September.....			67.5		46	.49		
October.....			48.0		28	1.65		
November.....			28.2			3.27	7.0	
December.....			30.5	60	1	1.25		
Sums.....								
Averages.....								
RECAPITULATION BY SEASONS—								
Winter months.....								
Spring months.....								
Summer months.....			67.9			12.69		
Autumn months.....			47.9			5.41		

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT SIOUX CITY, WOODBURY COUNTY.

BY U. G. PURSSELL, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			27.6	58	3	1.68	16.4	NW
February.....			13.4	45	-17	1.28	12.8	NW
March.....			24.7	53	-14	2.01		NW
April.....			52.6	63	16	2.22		NW
May.....			59.0	87	33	2.41		S
June.....			67.8	94	48	7.62		S
July.....			69.2	88	47	5.77		SE
August.....			70.2	98	40	3.54		SE
September.....			68.1	92	33	.91		S
October.....			50.5	80	26	3.04		NW
November.....			30.2	64	-9	.37		NW
December.....			30.9	60	-6	2.48		S
Sums.....			564.2	912	208	33.29	29.2	
Averages.....			47.0	76.0	17.3	2.77		
RECAPITULATION BY SEASONS—								
Winter months.....			24.0	54.3	-8.7	5.40		
Spring months.....			45.4	77.7	12.7	6.64		
Summer months.....			69.1	93.3	45.0	16.93		
Autumn months.....			49.6	78.7	18.3	4.32		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
STORM LAKE, BUENA VISTA COUNTY.

BY A. J. BOND, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.							
	Corrected for temperature only.	Reduced to sea level.						
January.....			24.3			1.61	16.0	
February.....			13.1	40	-20	1.02	9.8	
March.....			23.9	40	-10	1.33	8.0	
April.....			24.9	81 0	15	1.83	T	
May.....			57.6	84	38	2.88		
June.....			67.1	88	43	14.70		
July.....			68.2	86	41	5.22		
August.....			68.9	92	40	3.16		
September.....			67.5	88	30	1.70		
October.....			62.1	78	28	4.36		
November.....			28.4	61	-16	.72	6.0	
December.....			28.4	49	-8	2.28	3.0	
Sums.....			523.3			40.62	42.6	
Averages.....			43.6			1.70		
RECAPITULATION BY SEASONS—								
Winter months.....			21.4			4.91		
Spring months.....			35.1	70 3	12.7	6.04		
Summer months.....			68.0	88 7	41.3	23.09		
Autumn months.....			49.3	75.0	17.0	6.78		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
TIPTON, CEDAR COUNTY.

BY J. M. RIDER, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			28.7	47	9	1.90	2.2	N
February.....			25.1	63	-9	1.05	3.0	NW
March.....			29.8	52	1	4.15	21.0	W
April.....			51.5	78	21	2.80	1.0	W
May.....			50.4			5.71		NW
June.....			73.7	94	50	3.61		S
July.....			72.8	90	52	4.40		SW
August.....			71.1	94	48	6.98		S
September.....			68.3	90	41	1.28		S
October.....			50.6	88	28	1.38		
November.....			28.3	60	-13	3.23	5.0	
December.....			23.1	55	3	3.14	4.5	
Sums.....			592.4			38.63	36.7	
Averages.....			49.4			3.22		
RECAPITULATION BY SEASONS—								
Winter months.....			29.0	55.0	-1.3	6.09		
Spring months.....			46.9			12.68		
Summer months.....			72.5	92.7	50.0	13.99		
Autumn months.....			49.1	79.3	18.7	5.80		

ANNUAL REPORT OF THE  
ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
VINTON, BENTON COUNTY.

BY T. F. M'CUNE, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....			24.2	40	0	0.94	12.0	NW
February .....			20.1	48	-11	.87	8.0	NW
March .....			26.0	47	-3	3.28		NW
April .....			49.3	79	21	.84		NW
May .....			56.7	79	24	3.48		NW
June .....			67.5	89	49	4.31		SW
July .....			67.5	87	50	2.75		SW
August .....			67.1	92	43	3.24		SW
September .....			65.2	89	37	2.00		SW
October .....			49.1	77	27	2.99		NW
November .....			29.9	56	-14	1.35	2.8	NW
December .....			32.0	54	-1	2.58	3.8	SW
Sums .....			554.6	837	232	28.61	26.6	
Averages .....			46.2	69.8	19.3	2.36		
RECAPITULATION BY SEASONS—								
Winter months .....			25.4	47.3	-4.0	4.39		
Spring months .....			44.0	68.3	17.3	7.58		
Summer months .....			67.4	89.3	47.3	10.30		
Autumn months .....			48.1	74.0	16.7	6.34		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WASHINGTON, WASHINGTON COUNTY.

BY WM. A. COOK, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January .....			29.2	48	10	2.33		SW
February .....			26.9	58	-7	.88		SW
March .....			32.2	56	0	3.45	26.5	NE
April .....			54.6	82	22	.89	7	SW
May .....			60.9	84	34	1.65		NE
June .....			74.1	93	52	5.81		SW
July .....			72.1	95	50	4.46		SW
August .....			72.9	96	44	2.87		
September .....			72.4	94	56	.40		
October .....			53.5	90	30	1.19		
November .....			34.4	60	-9	3.07	3.00	NW
December .....			35.8	58	3	1.33	8.00	SW
Sums .....			619.0	919.0	285	28.30	3.75	
Averages .....			51.6	76.6	23.8	2.36		
RECAPITULATION BY SEASONS—								
Winter months .....			30.6	54.7	2.0	4.51		
Spring months .....			49.2	74.0	18.7	5.99		
Summer months .....			73.0	96.3	48.7	13.14		
Autumn months .....			53.4	81.3	25.7	4.66		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WEBSTER CITY, HAMILTON COUNTY.

BY C. M. TRUMBAUER, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.							
	Corrected for temperature only.	Reduced to sea level.						
January.....	22.6	50	0	1.87	4.0	.....	.....	.....
February.....	15.3	46	-14	.78	6.0	.....	.....	.....
March.....	25.1	56	-6	3.30	23.2	.....	.....	.....
April.....	49.1	74	22	.50	0.5	.....	.....	.....
May.....	59.8	90	32	2.82	.....	.....	.....	.....
June.....	68.1	92	44	4.52	.....	.....	.....	.....
July.....	67.8	101	42	4.87	.....	.....	.....	.....
August.....	.....	.....	.....	.....	.....	.....	.....	.....
September.....	66.2	95	36	1.74	.....	.....	.....	.....
October.....	46.7	78	22	3.02	.....	.....	.....	.....
November.....	27.6	63	12	2.62	3.8	.....	.....	.....
December.....	29.1	54	-6	2.57	9.5	.....	.....	.....
Sums.....	.....	.....	.....	.....	46.0	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	22.3	50	-6.7	5.30	.....	.....	.....	.....
Spring months.....	49.7	78.7	16.0	6.51	.....	.....	.....	.....
Summer months.....	.....	.....	.....	.....	.....	.....	.....	.....
Autumn months.....	46.8	78.7	15.3	7.38	.....	.....	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WINTERSET, MADISON COUNTY.

BY WM. M'KNIGHT, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....	.....	.....	26	31	22	.....	6.0	.....
February.....	.....	.....	24	32	17	.....	10.0	.....
March.....	.....	.....	20	37	23	.....	22.0	.....
April.....	.....	.....	52	61	44	.....	.....	.....
May.....	.....	.....	61.0	64	34	3.61	.....	SS
June.....	.....	.....	66.6	66	49	7.77	.....	SS
July.....	.....	.....	68.9	66	51	5.24	.....	NW
August.....	.....	.....	70.2	60	43	2.15	.....	S
September.....	.....	.....	68.0	57	42	.66	.....	SW
October.....	.....	.....	51.8	74	30	2.16	.....	.....
November.....	.....	.....	31.7	66	-5	.86	3.8	NW
December.....	.....	.....	32.7	58	0	2.55	5.0	S
Sums.....	.....	.....	565.9	799	349	.....	48.8	.....
Averages.....	.....	.....	46.8	66.6	29.1	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	27.9	40.8	13.0	.....	.....	.....
Spring months.....	.....	.....	47.3	60.7	33.3	.....	.....	.....
Summer months.....	.....	.....	66.6	68.3	47.7	16.20	.....	.....
Autumn months.....	.....	.....	60.5	77.0	22.3	8.73	.....	.....

ANNUAL REPORT OF THE  
ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WILLIAMS, HAMILTON COUNTY.

BY M. L. FULLER, VOLUNTARY OBSERVER.

	MEAN BAROMETRIC PRESSURE.		TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Corrected for temperature only.	Reduced to sea level.	Mean.	Maximum.	Minimum.			
January.....			22.4	40	-2	1.93	4.8	.....
February.....			14.3	43	-15	.76	6.0	.....
March.....			22.0	50	-14	2.45	14.1	.....
April.....			47.0	83	19	.86	0.1	.....
May.....			56.9	85	30	2.47	.....	.....
June.....			67.4	94	46	2.89	.....	.....
July.....			66.7	87	46	4.01	.....	.....
August.....			66.3	96	38	3.16	.....	.....
September.....			63.0	92	32	2.14	.....	.....
October.....			43.9	76	20	2.98	.....	.....
November.....			23.5	57	-18	.95	2.8	.....
December.....			26.0	53	-8	2.22	4.3	.....
Sums.....			519.4	856	174	26.83	31.9	.....
Averages .....			43.3	71.3	14.5	2.24	...	.....
RECAPITULATION BY SEASONS—								
Winter months..			20.9	45.3	-8.3	4.91	.....	.....
Spring months.....			42.0	72.7	11.7	5.79	.....	.....
Summer months.....			66.8	92.3	43.3	10.06	.....	.....
Autumn months.....			43.5	75.0	11.3	6.07	.....	.....

## METEOROLOGICAL DATA AT CEDAR RAPIDS.

BY H. D. OLDS, OBSERVER.

## JANUARY.

## FEBRUARY.

1885	30.091	10.06	69.7	1.85	17.10	
1886	30.068	31.06	77.7	1.27	5.95	
1887	30.012	16.06	78.7	4.07	5.00	
1888	30.100	20.60	77.6	1.27	14.00	
1889	30.190	19.06	73.6	1.87	4.25	
1890	30.141	28.72	74.9	1.04	4.25	
1891	30.035	23.27	79.2	1.12	3.65	

## MARCH.

1885	30.169	28.07	64.0	0.61	1.42	
1886	30.044	28.70	76.4	4.47	14.80	
1887	30.091	31.76	73.0	3.50	16.50	
1888	30.151	27.80	75.0	9.52	4.00	
1889	30.080	39.30	68.3	0.42	0.50	
1890	30.169	29.04	69.9	2.04	7.50	
1891	30.062	28.08	61.6	3.74	22.50	

## APRIL.

1885	30.104	45.71	68.6	7.82	Trace	All month.
1886	30.006	51.54	71.3	2.16	"	To 7th.
1887	29.944	49.52	73.8	0.98	"	To 23th.
1888	30.268	48.55	71.8	1.74	"	To 20th.
1889	30.070	47.80	69.4	2.91	"	1st and 30th only light.
1890	30.092	52.25	67.3	2.42	"	To 1st and 2d.
1891	30.043	51.82	74.8	1.63	0.75	To 12th.

## MAY.

1885	29.969	55.58	60.8	5.62		Light to 10th.
1886	30.019	62.50	70.0	2.69		Light to 17th.
1887	29.970	65.27	68.8	1.20		None.
1888	29.900	52.83	78.8	8.10		Light to 10th.
1889	29.930	57.50	70.4	5.15		Light to 2d.
1890	29.934	60.62	70.8	3.06	0.75	Light to 17th.
1891	30.072	67.51	72.6	4.11		3d, 5th, 6th, and light 27th.

## JUNE.

1885	29.971	67.58	63.3	3.45		Very light on 9th.
1886	29.996	71.11	62.1	1.23		Very light on 30th.
1887	29.986	74.06	67.9	2.53		None.
1888	29.880	69.80	69.0	2.29		None.
1889	29.851	65.27	71.4	4.11		None.
1890	29.938	74.23	66.7	9.54		None.
1891	29.897	69.27	73.6	3.21		None.

ANNUAL REPORT OF THE

JULY.

YEAR.	Mean barome- ter—inches— reduced and corrected.	Mean tempera- ture—degrees.	Relative hu- midity—per cent.	Precipitation— inches.	Snowfall— inches.	FROST.
1885.....	29.905	83.92	64.5	6.43	.....	.....
1886.....	29.960	77.23	60.25	0.57	.....	.....
1887.....	29.940	77.80	68.20	4.58	.....	.....
1888.....	29.998	75.96	70.2	6.03	.....	.....
1889.....	29.930	74.30	69.2	5.79	.....	.....
1890.....	29.954	75.53	68.9	1.97	.....	.....
1891.....	30.014	70.42	68.4	3.20	.....	.....

AUGUST.

1885.....	29.944	66.15	64.4	6.38	.....	.....
1886.....	29.972	78.53	61.6	1.70	.....	Very light frost, 31st.
1887.....	29.961	72.40	64.7	1.40	.....	.....
1888.....	29.990	68.10	69.	2.42	.....	.....
1889.....	30.000	71.20	67.5	1.65	.....	.....
1890.....	30.004	67.83	72.8	4.27	.....	.....
1891.....	29.985	69.82	72.0	5.44	.....	White, 28th.

SEPTEMBER.

1885.....	29.998	58.29	67.8	2.84	.....	Light 2d and 5th.
1886.....	29.922	64.10	71.0	2.86	.....	17th to 30th.
1887.....	29.976	63.30	69.8	4.93	.....	Light 23d and 24th.
1888.....	30.039	58.60	71.3	1.07	.....	13th and heavy 28th.
1889.....	29.071	60.46	71.1	3.70	.....	15th to 27th.
1890.....	30.082	59.56	71.7	2.90	.....	13th to 29th.
1891.....	30.072	67.63	68.0	1.81	.....	White 4th and 29th.

OCTOBER.

1885.....	29.974	45.04	68.9	2.50	.....	Killing, 5th.
1886.....	30.030	53.58	68.7	4.92	.....	1st to 31st.
1887.....	30.053	45.51	73.2	2.07	.....	5th to 31st.
1888.....	29.952	47.80	71.7	2.35	.....	1st to 31st.
1889.....	30.112	46.74	69.5	1.49	.....	6th to 31st.
1890.....	29.993	46.18	73.7	5.30	.....	14th to 31st.
1891.....	30.067	49.13	70.40	2.44	.....	16th to 31st.

NOVEMBER.

1885.....	29.961	35.55	73.3	0.63	0.25	Frost mostly during the month.
1886.....	30.033	33.55	75.6	1.50	4.80	
1887.....	30.048	34.25	70.6	0.79	3.25	
1888.....	30.167	36.50	72.3	4.12	....	
1889.....	30.082	35.06	71.1	1.03	1.50	
1890.....	30.136	39.30	70.8	1.87	0.25	Heavy thunder shower on 7th
1891.....	30.059	35.21	73.57	2.98	3.50	

DECEMBER.

1885.....	30.067	22.07	75.7	2.48	10.10	.....
1886.....	30.170	16.50	76.2	0.40	3.50	.....
1887.....	30.024	22.70	77.2	2.72	12.25	.....
1888.....	30.132	28.80	75.0	2.16	6.00	.....
1889.....	30.010	38.42	74.7	1.62	None.	.....
1890.....	30.165	29.10	73.2	0.40	4.15	.....
1891.....	30.034	32.75	77.8	1.77	2.00	.....

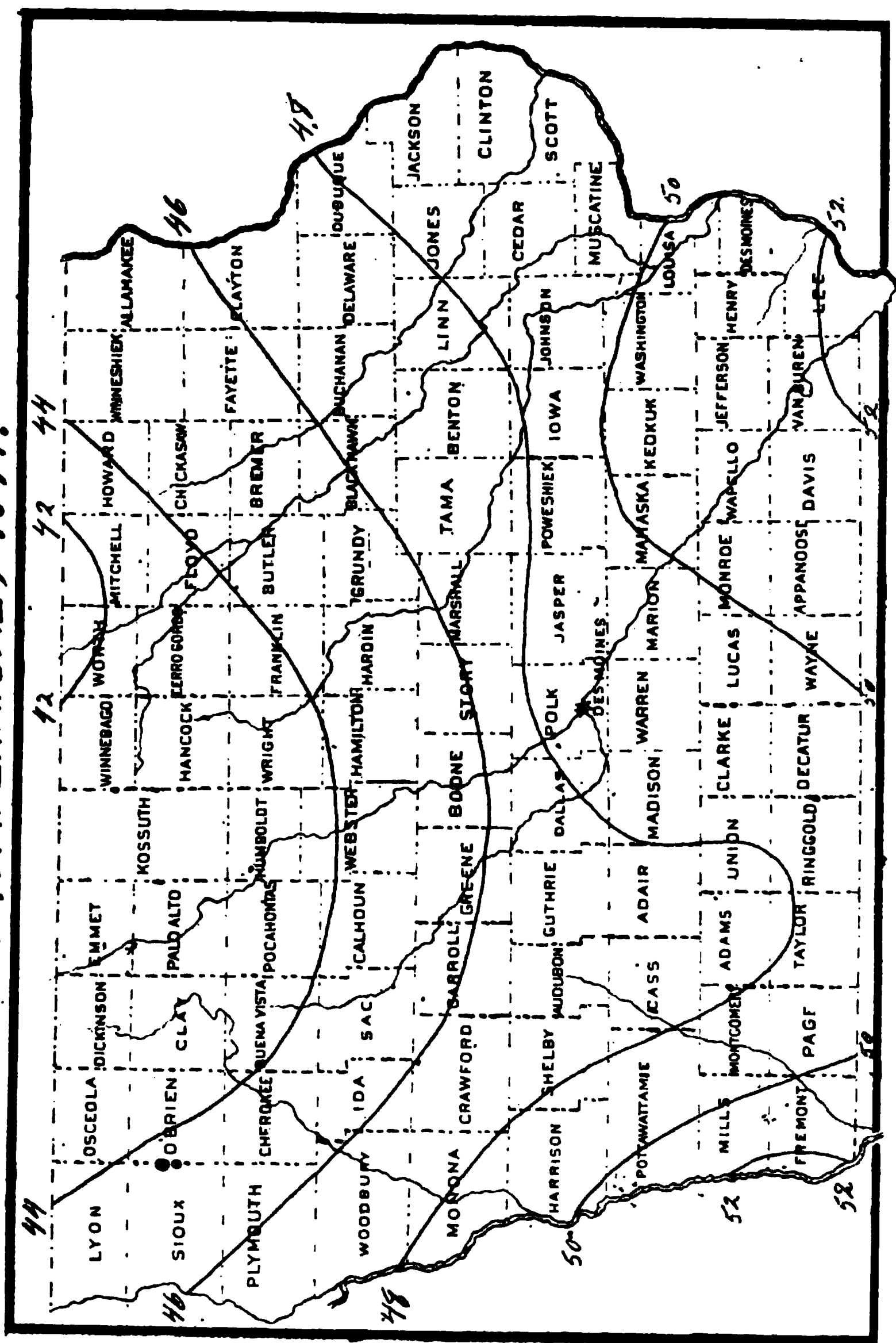
STATIONS.	OCT.		NOVEMBER.				DECEMBER.				ANNUAL.		
	Mean.	Total precip.	Max.	Min.	Mean.	Total precip.	Max.	Min.	Mean.	Total precip.	Max.	Mean.	Total precip.
			58				50			49	18	45.1	49.05
			58				50			49	15	45.0	48.00
			58				58			58	13	47.3	34.10
			53				60			53	20		38.19
			60				52	-1		55	27	44.1	36.18
			58				55			53	13	47.4	33.01
			70				64			50	16		
			64				58			58			
			64				56			71	17	46.3	41.63
			58				54			74	16	46.2	29.07
			60				55			77	12	48.2	33.25
			62				50			50	18		
			60				60			27	10	49.6	33.41
							62			73			
			57										
			58				51			44	31	43.6	28.19
			54				57	5	34.8	1.64	20	49.4	31.45
			66				61	0	34.8	1.54	10	48.7	30.14
			57				54	1	33.0	2.09	13	48.3	27.55
										83.93	20	44.2	40.98
			66				58			81.93	-6		
			50				51			53.18	20	44.9	32.60
			60				58			11.73	-4	53.3	23.48
							72			01.21	14	51.7	34.05
Glenwood	44.81		64				52			34.01	-7		
Grand Meadow	32.02		56				59			2.75	14	47.3	36.15
Greenfield	02.27		53				51			1.52	12	47.5	29.92
Grieland	22.34		50				54			72.33			
Grundy Center	02.75		57				52			32.68	18	43.9	36.15
Hampton	32.30		50				58			71.49	-8	48.1	32.59
Hopeville	52.14		46				53			2.65	12	48.6	32.50
Hopkinton	02.55		56				51			72.38	15	46.8	28.13
Independence	92.78		53				55			2.72	10	48.7	31.64
Iowa City	41.63		60				62			31.33	-6	51.5	33.24
Keokuk	51.49		68				50			2.93	23		
Larrabee	43.38		63				60			32.72	15	49.9	35.30
Logan	75.64		67				55			52.50	15		
Marshalltown	52.69						54			12.01	12		
Maxon	01.62		62				54			11.83	16	47.0	27.36
McCausland	5.85		53				57			2.09			
Monticello	82.16		57				56			2.51	13	47.4	34.17
Mt. Vernon			56				60			1.49	-4		
Muscatine	01.49		66				60			2.07	-9	49.6	34.92
Murray	42.01		66							3.15	22	42.4	24.79
Omaha, Neb.	05.37		66				56			2.96	14	49.7	27.01
Osage	13.09						64			3.70	11	46.8	26.56
Oskaloosa	92.03		65								24		
Panama	26.53		66				50			51.36			
Stilson	43.41						49			12.28	30	43.6	40.82
Sac City	85.86		62				60			2.48	17	47.0	33.29
Storm Lake	14.36		61				55			3.14	13	49.3	36.63
Sioux City	53.04		64				54			2.58	14	46.2	28.61
Tipton	61.38		60				56			1.33	-9	51.6	28.30
Vinton	12.99		58	-14	29.9	1.35				2.57	14		
Washington	51.19		60	-0	34.4	3.07				2.22	18	43.3	26.83
Webster City	73.02		63	-12	27.6	2.62				2.55	-5	48.6	
Williams	92.98		57	-18	23.5	.96							
Winterset	82.18		66	-5	31.7	.88							





*IOWA PRECIPITATION CHART, 1891.*

# MEAN TEMPERATURE, 1891.



## FINANCIAL STATEMENT,

*Showing the expenditures of the Weather and Crop Service for the year ending June 2, 1892, per itemized vouchers.*

DATE.	TO WHOM PAID.	ON WHAT ACCOUNT.	Voucher, num- ber.	Amount.
1891.				
June	30 J. R. Sage .. .	Salary as director, June .....	51	125.00
June	30 J. R. Sage .....	Expense acc't per vouchers. ....	52	3.40
June	30 Clara S. Baker .....	Clerical services .....	53	49.00
July	20 Jessie L. Pollock .....	Clerical services .....	54	7.00
July	31 J. R. Sage .....	Salary as director, July .....	55	125.00
July	21 J. R. Sage .....	Clerk hire and other expenses..	56	12.35
August	10 Mrs. M. M. Baker .....	Clerical services .....	57	15.00
August	31 J. R. Sage .....	Salary as director, August .....	58	125.00
August	27 J. R. Sage .....	Weather flags and other exp's..	59	14.95
September	30 J. R. Sage .....	Salary as director, September..	60	125.00
September	30 J. R. Sage .....	Expenses, clerk hire .....	61	9.50
October	13 Jessie L. Pollock .....	Clerical services .....	62	15.00
October	31 J. R. Sage .....	Salary as director, October .....	63	125.00
October	31 J. R. Sage .....	Clerk hire and other expenses..	64	14.15
November	5 J. R. Sage .....	Clerk hire .....	65	9.00
November	30 J. R. Sage .....	Salary as director, November ..	66	125.00
November	30 J. R. Sage .....	Clerk hire and expenses .....	67	24.60
December	30 J. R. Sage .....	Salary as director, December..	68	125.00
December	30 J. R. Sage .....	Clerk hire .....	69	21.00
1892.				
January	31 J. R. Sage .....	Salary as director, January...	70	125.00
January	31 J. R. Sage .....	Clerk hire and expenses .....	71	6.00
February	27 J. R. Sage .....	Salary as director, February...	72	125.00
February	27 J. R. Sage .....	Engraving and clerk hire .....	73	21.80
March	31 J. R. Sage .....	Salary as director, March .....	74	125.00
March	31 J. R. Sage .....	Clerk hire and stationery .....	75	4.70
April	21 Iowa Printing Company..	Printing, lithographing, etc....	76	512.60
April	27 J. R. Sage .....	Salary as director, April .....	77	125.00
April	27 J. R. Sage .....	Expense account .....	78	23.40
April	27 Mabel Hogin. ....	Clerical services .....	79	38.00
June	1 J. R. Sage .....	Book case for office .....	80	22.00
June	1 J. R. Sage .....	Salary as director, May .....	81	125.00
June	1 Mabel Hogin. ....	Clerical services .....	82	35.00
June	1 J. R. Sage .....	Clerk hire .....	83	4.00
Total .				\$2,362.45

\*This voucher covers the bill of the Iowa Printing Co. for printing and lithographing prior to April 16, 1891. The amount was allowed and included in the expense account of the year ending June 2, 1891, appearing in the first annual report as voucher No. 51, which was a clerical error. The money was drawn October 28, 1891, under voucher No. 63.







501 110,10  
~~Nov. 21/92~~  
(Ex. 10000)

UNITED STATES  
DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU.  
ANNUAL REPORT  
OF THE  
IOWA WEATHER AND CROP SERVICE,  
FOR THE YEAR 1892.

---

J. R. SAGE,  
*Director.*

GEO. M. CHAPPEL, M. D.,  
*Local Forecast Official, U. S. Weather  
Bureau, Assistant Director.*

---

DES MOINES:  
G. H. RAGSDALE, STATE PRINTER.  
1898.





UNITED STATES  
DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU.

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ANNUAL REPORT

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FOR THE YEAR 1892.

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PRINTED BY ORDER OF THE GENERAL ASSEMBLY.

DES MOINES:  
G. H. RAGSDALE, STATE PRINTER.  
1893.

~~Met. 217.3~~  
Sci 778.10

1893, Jan. 28.

J. N. Cope.  
New Mexico.

STATE OF IOWA,  
OFFICE OF THE IOWA WEATHER AND CROP SERVICE, }  
*Des Moines, October 1, 1893.*

*To his Excellency HORACE BOIES, Governor of Iowa:*

SIR—In accordance with the requirements of the law, I have the honor to submit herewith the third annual report of the Iowa Weather and Crop Service for the meteorological year, 1892, and including the expenditures of this service for the year ending June 2, 1893.

I am, sir, very respectfully,

Your obedient servant,

J. R. SAGE, *Director.*



## METEOROLOGICAL OBSERVERS AND STATIONS.

Following is a list of stations equipped with meteorological instruments, and the names of observers connected with this Bureau, from whom monthly reports of temperature and rainfall were received during the year 1892:

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Albia.....	George Price.....	Hopeville.....	M. T. Ashley.
Algona.....	James Barr, M. D.....	Hopkinton.....	Theo. Marks.
Alta.....	D. E. Hadden.....	Independence....	E. F. Wulfke.
Amana.....	Conrad Schadt.....	Indianola.....	Prof. J. L. Tilton.
Ames.....	E. O. Dickinson.....	Iowa City.....	Prof. A. L. Arner.
Ames.....	E. N. Eaton.....	Iowa Falls.....	J. B. Parmelee.
Ames, (4 m's S. W.)	Isaac Young.....	Keokuk.....	*Fred. Z. Gosewisch.
Atlantic.....	J. W. Love.....	Keosauqua.....	Prof. J. H. Landes.
Belle Plaine.....	H. W. Vandike.....	Larrabee.....	H. B. Strever.
Blakeville.....	James Rodgers.....	La Crosse, Wis...	*W. U. Simons.
Blackton.....	O. W. Thompson.....	Logan.....	Mrs. M. B. Stern.
Bonaparte.....	Hon. B. R. Vale.....	Mason City.....	Edw. E. Wilcox.
Carroll.....	Moses Simon.....	Manson.....	W. L. Thompson.
Cedar Falls.....	Prof. A. C. Page.....	Marshalltown....	L. S. Kilborn.
Cedar Rapids.....	H. D. Olds.....	Maquoketa.....	Dr. A. B. Bowen.
Centerville.....	J. I. Ong.....	Mechanicsville..	Rev. J. W. Hubbard.
Charles City.....	J. W. Smith.....	McCausland.....	Miss Ruby Pearl Barr.
Clarinda.....	A. S. Van Sandt.....	Milton.....	Hon. E. O. Holland.
Clinton.....	Luke Roberts.....	Moorar.....	F. G. Thomas.
College Springs...	A. A. Berry.....	Monticello.....	Henry D. Smith.
Concord.....	J. M. Elder.....	Mount Vernon...	Prof. A. Collin.
Corning.....	John W. Bixby.....	Mount Pleasant..	G. S. Helphrey.
Corning.....	Jerome Smith.....	Murray.....	A. W. Lewis.
Corydon.....	J. S. Whittaker.....	Muscatine.....	J. P. Walton.
Oresco.....	Gregory Marshall.....	Omaha, Neb.....	S. S. Bassler.
Davenport.....	*F. J. Walz.....	Osage.....	G. D. Pattingill.
Delaware.....	Wm. Ball.....	Oskaloosa.....	Joseph Boyd.
Denison.....	P. H. Schlumberger....	Panama.....	Wm. J. Wicks.
Des Moines.....	*Geo. M. Chappel.....	Postville.....	F. L. Williams.
Dubuque.....	*S. C. Emery.....	Richland.....	Wm. A. Shaffer.
Eagle Grove.....	C. A. Schaffter.....	Sarborn.....	T. D. White.
Eldora.....	Prof. C. F. Woodward...	Seymour.....	Hon. L. W. Lewis.
Elkader.....	G. A. Fairfield.....	Sibley.....	G. W. Baxter.
Emmetsburg.....	H. Conroy.....	Sidney.....	G. V. Swearingen.
Estherville.....	R. M. McKean.....	Sioux City.....	*U. G. Pursell.
Fairfield.....	J. Fred Clarke, M. D....	Spirit Lake.....	R. B. Young.
Fayette.....	R. Z. Latimer.....	Storm Lake.....	A. J. Bond.
Ft. Madison.....	Miss L. A. McCready....	Tipton.....	J. M. Rider.
Galva.....	Dr. D. W. Farnsworth...	Vinton.....	T. F. McCune.
Glenwood.....	Seth Dean.....	Villsca.....	Hon J. S. Boise.
Greenfield.....	J. G. Culver.....	Washington.....	Wm. A. Cook.
Grinnell.....	Prof. S. J. Buck.....	Webster City....	O. M. Trumbauer.
Grundy Center...	Charles G. Rogers.....	Winterset.....	Will McKnight.
Hampton.....	E. C. Grenelle.....	West Bend.....	Phil. Dorweller.
Havelock.....	P. H. Coquillette.....	Williams.....	M. L. Fuller.
Hawkeye.....	J. W. Bopp.....		

\*U. S. Weather Bureau.

## WEATHER-CROP OBSERVERS.

The larger number of meteorological observers, in the foregoing list, contributed weekly weather-crop reports, during the crop season from April 1st to October 1st. Weekly reports were also received from the following special observers who were not supplied with standard instruments:

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Afton.....	M. V. Ashby.....	Manning.....	H. W. Pollock.
Agency.....	J. H. Van Zant.....	Mapleton.....	A. Lamb.
Ames.....	Henry C. Wallace.....	Marshalltown....	Hon. J. G. Brown.
Albia.....	Wm. Mercer.....	Mason City.....	Wm. Nettleton.
Anita.....	I. A. McKinley.....	Mt. Ayr.....	Hon. Wm. Shriver.
Ankeny.....	Ed. Parmenter....	Mt. Pleasant.....	W. S. Wright.
Battle Creek....	A. Preston.....	Minburn.....	J. W. O'Brien.
Bloomfield....	George Duffield....	Mount Vernon....	Robert Smith.
Boone.....	L. C. Morris.....	Newton.....	J. P. Beatty.
Carbon.....	N. M. King.....	North English....	J. L. Williams.
Carson.....	G. N. Ferguson.....	Nevada.....	O. G. Ashford.
Centerville....	Henry Galley.....	Osage.....	E. W. Stacy.
Charles City....	W. B. Towner.....	Orange City.....	H. J. Vande Waa.
Charlton.....	M. J. Burr.....	Paton.....	Hon. Joshua Jester.
Clarksville....	F. M. Russell....	Pittsburg.....	G. C. Duffield.
Clermont.....	Ohas. Larrabee....	Polo Station.....	A. E. Miller.
Council Bluffs..	L. Prouty.....	Prescott.....	G. W. Iden.
Dedham.....	J. W. Kay.....	Paullina.....	Geo. Hakeman.
Danville.....	Sherman Matthews....	Rockwell City..	J. G. Palmer.
Emerson.....	D. B. Nims.....	Rock Rapids.....	D. E. F. Merrill.
Fontanelle....	W. H. Bridgman....	Rossville.....	F. B. Wiley.
Ford.....	W. W. Whitmore....	Sac City.....	Dr. C. Brown.
Fort Dodge.....	R. W. Blain.....	Sandusky.....	Z. Hollingsworth.
Geneva.....	Wm. H. Thompson....	Sageville.....	Hon. F. N. Knoll.
Hodge.....	James Piper.....	Shenandoah.....	Reuben Mullison.
Humboldt....	G. L. Tremain.....	State Center....	E. N. Thompson.
Hamlin.....	F. P. Moore.....	Sumner.....	John Dawson.
Humeston.....	S. H. Moore.....	Tama.....	W. G. Mallin.
Independence....	C. L. Thomas.....	Van Horne.....	Spencer Smith.
Indianola.....	T. B. Hammer.....	Wapello.....	O. P. Smith.
Iowa City.....	A. O. Price.....	Waukee.....	John Wragg.
Jefferson.....	S. M. Taylor.....	Wheatland.....	D. Beckman.
Leon.....	John Daykin.....	Winterset.....	H. A. Kinsman.
Larrabee.....	H. H. Carnahan.....	Wyoming.....	R. A. Norton.
LeMars.....	Hon. Henry Schrooten..	Wall Lake.....	T. E. Wilcox.
Ledyard.....	Frank Miller.....	Yankee.....	W. S. Nicholson.
Lawler.....	Hon. Wm. Glattly....	Walnut.....	F. L. Martin.
Lockridge.....	John F. Farman.....	What Cheer....	O. D. Lawrence.

## PUBLICATIONS.

Twenty-five weekly Weather-Crop Bulletins were issued during the crop season, the total number of copies distributed being about 35,000. Summaries of these Bulletins, giving the status and prospect of crops from week to week, were copied by the weekly and daily press, and were circulated by associated press and special dispatches.

The total number of copies of the Monthly Review distributed during the year was about 22,000, answering the constantly increasing requests for this publication.

## MONTHLY CROP REPORTS.

About the first of June the first regular monthly crop report was tabulated from the estimates of the ten hundred crop correspondents of this Bureau, showing the acreage and condition of the staple crops. Reports were also issued in July, August, October and December, and widely dis-

seminated through the Monthly Review, the press and other channels of communication to the public.

#### DISPLAY STATIONS.

Through the agency of the State service the daily weather forecasts of the National Bureau were widely disseminated to meet the increasing public demand, and the number of display stations has been materially increased. A very considerable per centage of the people are now receiving the benefits of the daily weather forecasts.

#### GENERAL REVIEW OF THE YEAR.

The mean temperature of the year 1892, for the State, was  $47.5^{\circ}$ , which is about the average for the past twenty years. The mean of 1890 was  $47.7^{\circ}$ , and in 1891 it was  $47.4^{\circ}$ —showing a notable adherence to the general average in years widely different in those features of the weather affecting crop production.

The winter months of 1892 were generally mild, with about the usual number of stormy days, and above the average amount of precipitation. The spring months were abnormally cold, wet and backward, with an unusual number of stormy days and excessive cloudiness, greatly retarding seeding and all farm operations. In fact, it was the most unfavorable spring known in Iowa within a score of years, and its effects were shown in decreased acreage of the staple crops and greatly diminished harvests. The summer was warm and more favorable for crops, and the fine autumn in some measure made amends for the unfavorable spring but the round-up of crops showed a great falling off in amount, compared with the magnificent yield of 1891. The State, however, produced abundantly, compared with other western states, and better prices in some measure compensated for the shortage in total production.

The average total precipitation (rain and melted snow) was 35.74 inches. The greatest amount reported was 48.77 inches at Dubuque; least amount, 24.78 inches at Sac City. The average snowfall was 31.7 inches; highest total reported, 50 inches, at Richland; least amount, 8 inches, at Glenwood. Over two-thirds of the average precipitation of the year fell in the six crop months—April 1st to October 1st.

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### MONTHLY WEATHER SUMMARY.

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#### JANUARY.

**BAROMETER.** The mean atmospheric pressure for the month was 30.221 inches. Highest observed, 30.760 at Bancroft; lowest, 29.421 at Clinton, on the 1st. The range for the State was 1.339 inches.

**TEMPERATURE.** The mean daily temperature for the month,  $15.8^{\circ}$ , was about the normal for the State. The eastern districts were relatively colder, ranging from one to four degrees below the normal. The highest monthly mean was at Glenwood and Fort Madison, both of which stations reported



23° as the mean for the month. The lowest was 9.1° at Williams. The maximum temperature reported was 76° on the 29th; the lowest 38° below zero at Atlantic on the 19th. Average monthly range for the State, 75.4°.

**PRECIPITATION.** The precipitation (rain and melted snow) was slightly above the normal amount in the southeastern and south central counties, and in a number of counties in the east central district. The average for the State, 1.09 inches, was slightly below the normal. The greatest amount reported was 3.13 inches at Fairfield; least amount, 0.10 inches at Bancroft. The average depth of snow fall was 6.9 inches; average number of days on which .01 inch or more of precipitation fell, 5.2. The average number of cloudless days was 15.8.

#### OBSERVERS' NOTES.

*Charles City*—J. W. SMITH. From January 6th to 20th the thermometer was below zero every morning, except the 7th, when it was 4° above, and the 11th, when just zero—an unusually low temperature.

*Clinton*—LUKE ROBERTS. The ushering in of January, 1892, was a duplicate of January of 1891—rain commencing on December 31st, continuing until 2 P. M., January 1st, when it turned to snow, continuing until 9 P. M. The depth was about two inches and wind very lively—23 miles an hour. Total wind movement for the month, 4,640 miles; prevailing direction, southwest. The storm period was from the 1st to 17th, with precipitation below normal. Enough snow fell to make passable sleighing. Weather was propitious for out-of-door business, except for the intense cold during the central portion of the month. The ice harvest was unusually fine, the crop being about 12 inches thick. On the 26th, at 10:30 P. M., a brilliant meteor, with train of fire, was observed in the southwest at an elevation of 40° above the horizon, moving northwesterly, disappearing below the horizon.

*Cedar Rapids*.—H. D. OLDS. The mean temperature of the month is lower than three years past, but higher than in January, 1885, '86, '87 and '88. But little wind accompanied any of the snow falls.

*Blockton*.—C. W. THOMPSON. A very fine January—no storms of any severity and no winds. Weather mostly clear and salubrious. Some blue-birds and robins have been seen, and wild geese were observed flying northward. Mostly red sunrises and sets.

*Blakeville*.—JAMES RODGERS. There have been twenty days of sunshine during the month, with very little wind. The wind was south, west, and northwest, in about equal proportions.

*Larrabee*.—H. B. STREVER. The cold wave which struck this place early in the month culminated in the extreme cold of January 10th, on which date the spirit thermometer registered 32.5° below zero, which is the coldest weather experienced here for years.

*Alta*.—DAVID E. HADDEN. Only a trace of snow on the ground on the 25th; roads wet and very muddy. A brilliant meteor on 26th at 6:45 P. M., between planets Jupiter and Venus. Aurora borealis on 2d, 3d and 4th; auroral glows on 28th from 11 P. M. to 6 A. M. of the 29th, quite bright, with occasional streamers from 4:45 to 5:30 P. M. on the 29th. On the 30th noticed about 8:30 P. M. a low arch, with dark segment, brightest at 9:00 P. M., visible till morning of 31st. Solar halo on the 16th; vertical column at sunrise, followed by snow during the day.

## FEBRUARY.

**BAROMETER.** The mean atmospheric pressure for the month of February was 30.149 inches. Highest observed, 30.702 inches at Cresco on the 15th; lowest observed, 29.362 inches at Clinton, on the 10th.

**TEMPERATURE.** The month was warmer than usual, the daily mean temperature 28.10, being about 6° above the normal.

The highest monthly mean was 35.9°, at Fort Madison; lowest, 21.7°, at Larrabee. The maximum temperature reported was 68°, at Glenwood, on the 17th; lowest temperature reported, 20° below zero, at Bancroft, on the 15th. The average monthly range was 55.8°.

**PRECIPITATION.** The month was characterized by an excessive amount of cloudiness, with prevalence of foggy weather; but the average precipitation for the State, 1.20 inches, was slightly below the normal. The greatest amount reported was 2.18 inches, at Cedar Rapids; least amount, 0.12 inch, at Elkader.

The highest velocity of wind was 42 miles an hour, at Grinnell. A thunder-storm was reported at Fort Madison on the 7th.

## OBSERVERS' NOTES.

*College Springs.*—A. A. BERRY. The month has been unusually mild for this climate, but very little sunshine, the moisture keeping the roads and yards very muddy. Fall wheat is all right, though somewhat small. It has withstood the winter remarkably well.

*Corning.*—JOHN W. BIXBY. The most peculiar characteristic of the month of February was the lack of sunshine for seven days—17th to 24th, during which foggy weather prevailed, and roads became very bad.

*Clinton.*—DR. LUKE ROBERTS. The month was warmer than any former February in fourteen years, except that of 1882. The mean temperature was 30.4°, and the average was 7.7° above normal. The lowest temperature for the month was 1° on the morning of the 15th. Precipitation was below normal, being only 1.76 inches, of which .91 fell on the 6th and 7th. A little snow on the 28th. Cloudiness prevailed during the entire month, especially the last half; only one entire clear day. Total run of wind, 5,470 miles, being 300 miles in excess of normal. Maximum velocity, 18 miles an hour; prevailing direction, northeast and northwest. An electric storm of considerable magnitude prevailed on the 13th, extending over a large area of the northern portion of the United States from the Missouri valley to the Atlantic. This was visibly manifest in the evening, when a magnificent display of aurora borealis illuminated the northern hemisphere.

*Blockton.*—C. W. THOMPSON. The winter has been very "open" and favorable to agricultural interests. Everything seems to indicate an early spring. Streams free from ice. Frost nearly out of ground at close of February.

*Belle Plaine.*—H. W. VANDIKE. Temperature for February was the highest we have on record, being 8° higher than in 1890, and 7° higher than normal obtained from a record of nine years at this section. Only eleven days during which the mean temperature was below freezing. Muddy roads have been the rule, the worst known for years.

*Amana.*—CONRAD SCHADT. On the 13th a brilliant aurora was visible about 6:15 P. M. It was a fiery red sheet reaching a height of about 25°,

through which rays of white light were shooting upwards and above it. The sublime phenomena lasted only forty-five minutes. Ducks and geese were flying northward on the 25th.

*Logan.*—MRS. M. B. STERN. The month has been remarkable for the number of cloudy days; foggy but not much precipitation. The peewees and bluebirds were with us on the 8th. Wild geese flying northward on the 9th and 10th.

*Carroll.*—MOSES SIMON. We had seventeen cloudy days during February. From the 17th to the 29th there was very little sunshine. Roads were in worse condition than they have been for many years.

*Blakeville.*—JAS. RODGERS. The wind has been variable, changing from southeast to northeast. We have had twenty cloudy days during February; balance clear and mostly warm for the season.

#### MARCH.

**BAROMETER.** The mean atmospheric pressure for the month was 30.113 inches. The highest observed was 30.849, at Grinnell, on the 27th; lowest, 29.323 inches at Clinton on the 9th. Range, 1.526 inches.

**TEMPERATURE.** The mean temperature,  $31.9^{\circ}$ , was about the normal for the State. The highest monthly mean was  $38.8^{\circ}$ , at Fort Madison, and the lowest  $26.6^{\circ}$ , at Osage. The maximum reported was  $48^{\circ}$ , at Glenwood on the 3d; the lowest  $6^{\circ}$  below zero, at Glenwood on the 10th. The average range for the State was  $60.3^{\circ}$ .

**PRECIPITATION.** The average precipitation for the State, 2.22 inches, was slightly above the normal amount for March, and it was well distributed. Logan received the greatest amount, 4.58 inches; least amount 0.57, at Elkader. Average depth of snow fall, 3.9 inches. The month was characterized by more than the average amount of cloudiness and foggy weather, and the country roads were well nigh impassable. But little field work was done. There were three days of excessively high winds; greatest velocity reported, 54 miles an hour, at Davenport on the 9th.

#### OBSERVERS' NOTES.

*Fayette.*—R. Z. LATIMER. The ice was nearly all out of the streams by the 8th, and on that date bluebirds were seen and the sap ran freely. But on the 9th one of the worst blizzards ever known in this section continued all day and evening; velocity over 40 miles an hour.

*Cresco.*—GREGORY MARSHALL. On the 9th about 9 A. M., the wind became a gale from the northwest which continued all day more or less violent, being the most decided blizzard we have had for years. Traffic on the railroad was impeded.

*Belle Plaine.*—H. W. VANDIKE. The temperature dropped  $47^{\circ}$  in 30 hours, from 3 P. M. on the 8th, to 9 P. M. on the 9th. On the 9th the wind attained an estimated velocity of 40 to 45 miles an hour. The pressure at 7 A. M. of that day (reduced) was 29.49 inches. Robins and bluebirds first appeared on the 3d. On the night of the 31st the wind blew 40 miles an hour and was increasing in force.

*Alta.*—DAVID E. HADDEN. About midnight of the 8th of March the wind suddenly changed to the northwest with terrific force, and continued to the

forenoon of the 10th, when it began to decrease and calm succeeded at 9 P. M. It was accompanied by a cold wave; between 3 P. M. of the 8th and 3 P. M. of the 9th, the fall in temperature amounted to over 40 degrees. Chimneys and metal roofs were blown off, and other minor casualties were the result of the gale, which was the severest experienced here in many years. The roads in March were the muddiest ever known here at this time of year.

*Clinton.*—LUKE ROBERTS, M. D. The behavior of March was very satisfactory, compared with its thirteen predecessors. The most notable storm was the blizzard of the 9th, when the wind velocity averaged 20 miles an hour for 24 consecutive hours. The maximum velocity was 28 miles from 10 A. M. to 3 P. M.; minimum, 18 miles. It came from the west, with snow most of the time, but not sufficient to cover the ground. Temperature fell to 5° above zero.

*Larrabee.*—H. B. STREVER. A few minutes before midnight on the 8th, the wind changed from south to northwest and blew a gale of 40 miles an hour; but little damage was done. Blackbirds and robins appeared on the 7th.

*Logan.*—MRS. M. B. STERN. The month was remarkable for number of cloudy days and high winds on the 9th, 10th and 31st. But little damage done.

*Glenwood.*—SETH DEAN. The wind-storm of the 9th was very severe, unroofing a few buildings, prostrating some fences and blowing over several windmills and towers.

#### APRIL.

**BAROMETER.** The mean atmospheric pressure for the month was 30.016; highest observed, 30.460 inches, at Clarinda, on the 9th; lowest observed, 29.110, at Sioux City, on the 10th. Range, 1.350 inches.

**TEMPERATURE.** The mean temperature of the month, 45.4°, is about 2.6° below the normal for the State, making it the coldest April recorded since 1881. The highest mean recorded, was 51.5°, at Fort Madison, and the lowest, 41.1°, at Williams. The maximum temperature reported, was 88°, at Sioux City, on the 30th, and the lowest, 14°, at Sioux Falls, on the 10th. The range for the State was 74°.

**PRECIPITATION.** The average precipitation was 4.75 inches, which is about two inches above the normal for the month. The moisture was generally well distributed, the least amount reported being 2.43 inches, and the greatest amount, 8.33. In this was included an average snowfall of 5.7 inches. It was altogether the wettest April recorded in Iowa within the past ten years.

**WIND MOVEMENT.** The total wind movement was above the average. On the 1st high winds prevailed over the entire State. The maximum velocities recorded at the various United States Weather Bureau stations were as follows: Des Moines, 64 miles an hour; Sioux City, 60; Davenport, 60; Omaha, 42; Keokuk, 40; Dubuque, 32. The storm caused considerable damage in the aggregate to roofs, chimneys and light frame structures. But there was nothing to justify the exaggerated reports sent abroad descriptive of the "awful effects of the great Iowa cyclone." The wind storm was caused by an extended "low," which on that date was central in northern Kansas and southern Nebraska, and high velocities were general throughout the west and northwest.

**THUNDER STORMS.** Occurred on the 1st, 2d, 3d, 4th, 9th, 12th, 13th, 17th, 18th, 19th, 20th, 25th, 26th, 27th, 29th and 30th.

**HAIL.** Charles City, 20th; Ames, 26th; Alta, 30th; Algona, 30th; Amana, 4th; Atlantic, 3d; Grand Meadows, 30th; Greenfield, 3d; Indianola, 13th; Independence, 13th; Hopkinton, 13-20th; Hampton, 30th; Marshalltown, 30th; Monticello, 4-13th; Murray, 13th; Winterset, 20th; Williams, 1st; Osage, 1-30th; Storm Lake, 30th; Grundy Center, 30th.

#### OBSERVERS' NOTES.

*Ames.*—F. C. DICKINSON. High wind on the 1st; unusually heavy rain on night of 3d. Grass was green on the 1st. Budding of willow early in the month.

*Algona.*—JAMES BARR. On the 13th and 20th the heavy snow fell. On the night of the 30th there was a considerable noise for some time preceding the storm, sounding like a train of cars.

*Bonaparte.*—HON. B. R. VALE. A very cold, cloudy and rainy month; vegetation backward.

*Blockton.*—C. W. THOMPSON. Severe wind storm April 1st; frost the 28th; very cloudy, and spring work two weeks behind.

*Clinton.*—LUKE ROBERTS. Weather was about usual in temperature, but gave an excess of precipitation, cloudiness, storm days and movement of wind. The spring is about two weeks late. Cherry trees which usually are in full bloom at the close of April showed only faint signs at that time. The principal storm of special interest was that of the 1st, which was accompanied by a destructive wind. One of our new factories had its roof taken off and dashed to the ground in a splintered condition; another adjoining factory received some damage; also some houses, lumber, etc., suffered loss. The greatest precipitation occurred the 3d and 4th, measuring two inches. The greatest downpour was between 9 and 10 P. M., of the 3d. Lightning killed two valuable horses standing together not far from a barn. It was wetter at close of month than previously.

*Delaware.*—WM. BALL. April was remarkable for lack of sunshine, and the season at its close was one week later than last year.

*Keosauqua.*—J. H. LANDES. On the 1st there was a high gale that blew down fences, stacks, chimneys, etc., and did some damage to light buildings. Considerable snow fell on the 14th, coming with rain and melting as it fell. Frost on 29th did no damage.

*Fayette.*—R. Z. LATIMER. The high wind on afternoon of the 1st did no damage here, except to a few small buildings and chimneys. Plowing commenced on the 1st; but very little grain was sown before the 7th. Seeding was fully two weeks late.

*Greenfield.*—J. G. CULVER. On the 1st many chimneys were blown down by the high wind. At the court-house slates were blown from the roof. Many sheds and a few small barns were destroyed.

*Grand Meadow.*—F. L. WILLIAMS. March 31st and April 1st a perfect gale came from the southeast and southwest, which blew down some trees but no buildings. The ground is more thoroughly soaked than it has been in five years.

*Corning.*—J. W. BIXBY. The high wind on the 1st did considerable damage in this part of Iowa, and the wet weather has prevented sowing small grain. The prospect is not favorable for large crops. During April there were only 10 clear days, 5 fair, and 15 days in which the sun failed to show up, and we were thinking of offering a reward for his return.

*West Bend.*—PH. DORWEILER. The month was very unfavorable for farm work, and roads were almost impassable. Season two weeks late.

*Storm Lake.*—A. J. BOND. The month averaged about 6° colder than last year, and at its close the season was one week late.

*Williams.*—M. L. FULLER. This has been the coldest and wettest April in the five years of my observations. Heaviest rain on the 3d, 1.72 inches. Maples and box elders budded by the 23d; willows and orchard trees on the 26th and 28th.

*Murray.*—A. W. LEWIS. A very high wind occurred on the 1st, doing considerable damage to buildings, trees, etc. On the 13th rain fell to the depth of 1.50 inch in 1 hour and 30 minutes. There was also heavy hail, covering the ground on that date.

#### MAY.

**BAROMETER.** Mean pressure for the month, 29.901 inches; highest observed, 30.38 inches, on the 18th, at Dubuque; lowest observed, 29.27 inches, on the 18th at Dubuque; range for the State, 1.11 inches.

**TEMPERATURE.** The temperature of May was abnormally low, the mean for the State being 54°, which is 5.7° below the normal. The maximum reported was 88° at Glenwood, on the 24th; lowest, 29° at College Springs on the 10th. The monthly range for the State was 59°.

**PRECIPITATION.** The average precipitation for the State was 8.77 inches—a little more than double the normal amount for May. Osage reported the least amount, 4.87 inches, which is slightly above the normal for that locality. The heaviest measurement was 12.64 inches at Seymour, in Wayne county. All portions of the State were thoroughly soaked, and in the larger part there was a great excess of moisture. There was very little sunshine, and the records at the Central Station showed 76 per cent of cloudiness. Farm work was greatly retarded, and very little planting was done. It was altogether the most unfavorable May for farming operations known in Iowa for a quarter of a century.

The soil was thoroughly saturated at the close of April and the enormous rainfall in May overtaxed the capacity of the streams, causing great destruction of crops, fences, bridges, live stock and even buildings in some localities. The greatest destruction was wrought at Sioux City on the 17th and 18th by the sudden rise of the Floyd river, when nine persons were reported drowned, and the loss of property aggregated more than a million dollars. The Des Moines river floods at Des Moines, Ottumwa, Fort Dodge and Keokuk also caused very heavy damage. In fact, there were but few counties that escaped a measure of loss by the unprecedented floods, and May, 1892, will be referred to in future years as a breaker of records and a maker of high water marks. It was a month of disasters throughout the Mississippi valley.

**SNOW.** Charles City, 20th. Corning, Clarinda, Centerville, Cedar Rapids, Glenwood, Indianola, Keosauqua, Larrabee, Monticello, McCaus-



land, Oskaloosa, Osage, Sac City, Storm Lake, Seymour, Williams, West Bend.

THUNDER STORMS. 1, 2, 3, 4, 5, 8, 9, 10, 13, 14, 15, 16, 17, 18, 24, 27, 28, 29, 30.

SLEET. Charles City, 20th; Fairfield, 20th; Independence, 20th; McCausland, 21st; Tipton, 19th; Williams.

HAIL. Charles City, 20th; Eagle Grove, 17th; Fairfield, 14th; Greenfield, 2d, 18th, Grundy Center, 14th, 25th; Indianola, 20th; Murray, 1st, 2d-McCausland, 27th; Osage, 25th; Tipton, 19th.

FROST. 3, 4, 6, 7, 8, 10, 11, 12, 20, 21, 22 and 27.

OBSERVERS' NOTES.

Delaware.—WM. BALL. May came in with a heavy rain and went out with a soaking downpour, delaying planting. About two-thirds of the corn was planted at close of month, but some of the seed rotted. Grass and oats on upland doing well. Season 14 days later than last year. Fruit prospect good, except strawberries.

Belle Plaine.—H. W. VANDIKE. No excessive downpour of rain, but almost one continuous "drip-drip." A large percentage of the corn planted between the 7th and 25th of May must be replanted. Below I give mean temperature and precipitation for May in the years named from records at this station:

YEARS.	Temperature— degrees.	Precipitation— inches.
1884.....	62.0	.....
1885.....	58.8	.....
1886.....	61.5	2.83
1887.....	65.5	0.90
1888.....	53.2	5.81
1889.....	59.7	5.12
1890.....	58.9	4.34
1891.....	57.6	4.21
1892.....	54.6	6.12

Cedar Rapids —H. D. OLDS. Vegetation at close of month was two weeks or more late. Trees in full leaf. Water in the Cedar river but little higher than the spring rise. Wells and springs full. Grass and stock doing well. Prospect for corn not flattering.

Harrison (Logan)—The month was remarkable for cold rains and cloudiness. There was quite a storm of hail and snow on the 20th, melting as it fell. Low lands mostly under water through the month. Fruit considerably damaged.

Mechanicsville.—J. W. HUBBARD. The position of the sun was scarcely discernible for days at a time. Rye and upland oats looking well. Rain-fall, 8.94 inches, and June opened with promise of doubling that; and yet the subsoil needed all the moisture.

West Bend.—PH. DORWEILER. The wettest May on record. Everything two or three weeks backward.

Williams.—M. L. FULLER. Rain fell on 21 days in May, the heaviest occurring on night of 4th and 5th, measuring 1.53 inches. On evening of the 14th about .85 fell in 15 minutes.

**Monticello.**—H. D. SMITH. The maximum temperature for May since 1854, was 95°, in 1856; minimum for same period, 25°, in 1885; normal, 59.8°; maximum rainfall 7.97 inches, in 1858; minimum, 0.76, in 1874; normal rainfall for the month, 3.85. May, 1892, breaks the record for rain over 1858, the total being 9.58 inches.

**College Springs** —A. A. BERRY. A very backward month, with low temperature and excess of rainfall. But little spring wheat sown. Not an average acreage of oats; fully 5 per cent of oat ground is bare. Fall wheat gives promise of two-thirds of a crop, or a little more than 16 bushels per acre. Fruit injured by frost. Ten per cent less than average acreage of corn planted.

**Cresco.**—GREGORY MARSHALL. The combined rains of April and May this year, 11.88 inches, amount to more than that of the same months during the past twenty years.

**Corning.**—J. W. BIXBY. Too much cloudy and rainy weather for farm work. The month winds up with a heavy rain and wind in northwest, with no promise of a cessation of hostilities.

**Blakeville.**—JAMES RODGERS. Prevailing wind for the month southeast with excessive and cloudy weather. Corn planting three weeks late.

**Blockton.**—C. W. THOMPSON. A great amount of rain has fallen this month and crops are backward. Some damage to railroads and bridges by floods.

**Muscatine.**—J. P. WALTON. There has been a rainfall of 10.32 inches during the month of May, 1892. No such record has been made here since 1851. It has rained sixteen different days, and we have had sixteen cloudy days. The mean temperature has been two degrees below the mean since 1839. Maximum temperature, 76°; minimum, 37°; mean, 55.7°. There has been no damaging frost during the month.

**Concord.**—J. M. ELDER. The following table shows the May precipitation at this station since 1878:

YEARS.	Precipitation — inches.	YEARS.	Precipitation — inches.
1878 .....	2.09	1886 .....	3.06
1879 .....	8.06	1887 .....	0.00
1880 .....	1.72	1888 .....	4.15
1881 .....	2.70	1889 .....	2.25
1882 .....	2.06	1890 .....	2.87
1883 .....	4.00	1891 .....	1.51
1884 .....	2.10	1892 .....	6.01
1885 .....	2.70		

**Oskaloosa.**—JOSEPH BOYD. The month of May was very wet, cold and backward, with high water, which did considerable damage to bridges and other property.

**Keosauqua.**—JOHN H. LANDES. The month has been very discouraging to farmers. No corn was planted until the 24th, which was soon stopped by more rain. One noticeable feature about the month's weather was the absence of thunder and lightning, though it was a rainy month. The Des



Moines river has been nearly bank full the entire month, and on the 23d reached the highest point that has been observed in many years.

#### JUNE.

**BAROMETER.** The mean atmospheric pressure was 29.905 inches. Highest observed, 30.268, at Omaha on the 25th; lowest, 29.510, at Sioux City on the 10th. Range for the State, 0.758 of an inch.

**TEMPERATURE.** The average temperature for the State was 69.2°, which is about the normal. There were cool periods, which gave an impression that it was a colder month than the records indicate. The highest monthly mean was 75.9°, at Bonaparte; lowest, 63.5°, at Cresco. The maximum temperature reported was 102°, at Glenwood on the 15th and 29th; lowest, 42°, on the 2d at Bancroft and Centerville. The range for the State was 60°.

**PRECIPITATION.** The average for the State was 5.19 inches—slightly above the normal for June. The distribution was variable, ranging from 0.67 at Glenwood to 14.16 inches at Dubuque. Thunder-storms occurred in some localities on every day of the month, except the 2d, 3d, 4th and 9th. A slight frost occurred in northern localities on the 30th.

#### OBSERVERS' NOTES.

*Seymour.*—HON. L. W. LEWIS. On the evening of July 1st, 3.81 inches of rain fell, the storm beginning at 8:30 P. M., and continuing until 2:30 A. M., of the 2d inst. It was a severe electric storm. The lightning struck S. Lewis & Son's brick block, tearing off the fire wall for twenty feet, breaking through ceilings and through stoves on two floors.

*Grand Meadow.*—F. L. WILLIAMS. The storms have been very frequent and violent. Damage to fields by washing is great, and considerable stock has been killed by lightning.

*Amana.*—C. SCHADT. The heaviest rainfall for many years occurred June 1st. In the course of six hours, from 12 to 6 P. M., 2.97 inches fell. Many bridges were swept away. In 62 hours 5.03 inches fell.

*Fayette.*—R. Z. LATIMER. This section was visited by heavy electric storms from the 13th to 23d inclusive, the lightning striking buildings and killing some stock, mostly lying near wire fences. The rains were heavy, doing much damage to property on low lands. On Sunday, the 26th, a small tornado passing from west to east, about fifteen rods wide, swept through the south part of this town. It had a rotary motion, twisting trees and hurling them in opposite directions; and the same with small buildings and loose property. The roaring was like the sound of a train of cars. Some damage was done to small buildings and wind-mills in its pathway. About the same time (3 P. M.), another small one passed nine miles south, blowing down a house and two barns. No lives lost.

*Bonaparte.*—HON. B. R. VALE. After the first week in June, following an excessively wet May, the month has been seasonable, giving fair results as the average June. The trouble was in having nothing done in corn culture till in this month.

*Blockton.*—C. W. THOMPSON. Hail fell in moderate quantities on the 13th and 19th, some stones on the 13th being large as hen's eggs. On the 16th lightning struck several places. On the 19th clouds and wind appeared

very threatening, and people sought places of safety, but no damage was done.

*Alta.*—DAVID E. HADDEN. On the 19th, from 2:30 to 4:30 P. M., a destructive thunder-storm occurred, passing from northwest to southeast, with heavy rain and wind. The temperature fell  $30^{\circ}$  in two hours; the wind blew outward in all directions from the storm during its passage. At about 3:30 P. M. lightning struck the Alta roller mill, and it burned to the ground. Loss, about \$10,000. On the 20th, thunder-storms all night at frequent intervals, with heavy rain. Many telephone poles near town struck by lightning. On the 12th, about 10 P. M., a destructive hailstorm passed west of Alta, from about ten miles southwest to ten or fifteen miles northeast. Hail as large as eggs are reported, breaking hundreds of windows and limbs of trees. A light frost was observed on low places on morning of 30th.

*Monticello.*—HENRY D. SMITH. Maximum temperature for June since 1854,  $102^{\circ}$  in 1856 and 1870; minimum,  $36^{\circ}$  in 1855; normal for the month,  $68.88^{\circ}$ . Highest rainfall recorded in June, 12.19 inches in 1830; minimum, 0.74 in 1857; normal, 4.28 inches. On the 16th a windstorm blew down two barns, about five miles north to northeast of this place.

*Mechanicsville.*—J. W. HUBBARD. Rainfall on 19 days in June. There was a great deal of lightning. Three clear days; six fair days.

*Hopkinton.*—THEO. MARKS. In June, 1892, the maximum temperature was  $90^{\circ}$ ; minimum,  $50^{\circ}$ ; mean,  $67^{\circ}$ . Rainfall, 10.13 inches. Average mean temperature for 40 years,  $69^{\circ}$ .

*College Springs.*—A. A. BERRY. June has been a very favorable month, excepting lack of rain, making the ground cloddy. Corn is regaining lost ground, and is only about two weeks later than last year. It is a good stand and free from weeds. Fruit a short crop, excepting grapes. Taking it all in all farmers have no cause to complain.

*Cedar Rapids.*—H. D. OLDS. Highest water in the river during the season was the 24th; five to six feet higher than in the spring raise. There has been no very severe storm during the month, or damage to life or property by lightning, but there were some fine displays of atmospheric electricity, especially the 21st to 23d.

#### SEVERE LOCAL STORMS.

Special storm reports received from meteorological observers of this service and others, indicate that portions of the State were visited by some exceptionally heavy and destructive storms during the period from the 15th to the 22d. The following descriptions are condensed from reports of the most severe and destructive of these disturbances.

**JUNE 15TH AND 16TH.** On these dates a series of severe local storms occurred in the N. E. district and in contiguous counties in the N. C. and E. C. districts. Dr. J. W. Smith, of Charles City, writes that there was a moderate shower in the morning of the 15th. At 12 M. it was very dark, followed by floods of rain and pretty sharp lightning. The total rainfall day and night measured 2.05 inches. Fourteen miles E. by N. E. crops were destroyed within a limited territory by hail.

Gregory Marshall, of Cresco, says the 15th was a day of note as regards frequency of thunder-storms, the first beginning at 7 A. M. At 12:10 P. M. a

violent thunder-storm began, continuing till 1:30 P. M., with a total rainfall of 1.20 inches in that length of time. The heaviest storm came up at 10:20 P. M., with heavy lightning and a deluge of rain lasting till after midnight. The total in 18 hours was 3.07 inches. Damage was done to crops by washing and floods. L. F. Emmons lost five head of stock by lightning, and others less number, mostly in Orleans township. A church was struck and badly damaged by lightning.

J. W. Bopp, of Hawkeye, Fayette county, reports heavy downpours at that place on the 15th and through the night, with a total of 2.48 inches, causing much damage to crops.

James Rodgers, of Blakeville, Black Hawk county, describes a wind-storm that passed in his vicinity on afternoon of the 16th. A funnel-shaped cloud was formed. The storm blew down a hay barn belonging to Hollis Garrett; also destroyed the horse barns, hog house and work shop of a Mr. Fuller, and partially wrecked the farm buildings and dwelling house of A. C. Bratnober. The breadth of the track was about 150 feet, and distance traversed, 4 miles.

At Monticello on the 16th, according to report of Henry D. Smith, there were two storms of much severity. The first began at 8.05 P. M. and ended 8.25 P. M. It was a thunder and wind storm (a straight blow); the wind having sufficient force to blow a large barn to pieces about 5 miles N. E. of Monticello. Some men and horses were in the barn, but were not seriously injured. The second storm, from 4:20 to 11 P. M., was distinguished by several lightning strokes within a mile. The steeple of the U. B. church was struck; also numerous trees.

Observer S. C. Emery, of Dubuque, reports four distinct thunder-storms on the 16th, resulting in heavy floods and some damage by lightning. One building was struck by lightning, and four persons severely injured. The rainfall within 24 hours amounted to 3.50 inches, resulting in washouts on the railroads and damaging local floods.

**JUNE 22D AND 23D.** By far the most damaging storms occurred on the 22d, continuing till the morning of the 23d. It extended over the whole of the Northeast district, and a portion of the East Central district.

James Rodgers, of Blakeville, reports a heavy fall of rain, accompanied by lightning, hail and wind, the storm beginning at 6 P. M. and continuing till midnight. The rainfall measured 3.25 inches, causing washouts on the railways, destruction of bridges, and much local damage. The hail was not destructive.

F. L. Williams, of Grand Meadow, Clayton county, reports a very heavy wind and thunder-storm on the evening of the 22d, the rainfall in thirty minutes measuring 2.58 inches. More buildings were struck and more stock killed than for a number of years.

#### **A TORNADO IN CHICKASAW AND BREMER.**

In the above counties the storm of the 22d. culminated in a small-sized but very active tornado, which wrought heavy damage within its narrow pathway. Mr. E. C. Bennett, of Tripoli, contributes the following description of the storm. He says :

“The counties of Chickasaw and Bremer were visited by a destructive tornado on the afternoon of June 22d. It had been hot and sultry, with a

sense of oppression felt by every one in the vicinity, but not to an extreme degree. The wind was blowing from the south at a rate of about six miles an hour when a dense cloud formed in the north with the well-known indications of wind squalls. At a point about three miles east of Nashua, in Chickasaw county, observers noticed the formation of the funnel characteristic of a tornado. This funnel first struck the earth upon the farm of T. L. Smith, destroying wind-mill and outbuildings. The course of the tornado assumed an easterly and southeasterly direction, not in a straight line but zigzagging with no apparent course. In Chickasaw county the chief losses were sustained by the following persons: W. P. Allison, barn; Mrs. Moines, barn; John Hicks, house; Mr. Laydon, house; George Usher, house; Mr. Edson, house and barn; Jacob Parsons, house; L. E. Dilley, house; John Sheldon, house and barn; Nels. Hansen, barn; Mike Fiene, barn; George Chambers, barn; L. H. Miller, house. The casualties, considering the destruction done, were happily very few. The tornado next passed into Bremer county, gaining in force and breadth, sweeping everything in its path for a width of 80 to 80 rods, occasionally widening to nearly a mile, then lifting clear from the ground, coming down again in other places. The onward movement was not particularly rapid, probably about sixteen miles an hour, and the time occupied in passing any given point but a few minutes, perhaps fifteen, although some who were in it estimated it at a full hour, but this evidently included the gale which accompanied the tornado. Buildings were literally made into kindling wood and the slivers struck in the fields and meadows, making them look as if the farmers were trying to raise timber by sticking out slivers. Chickens were stripped of their feathers; tall willow trees were pulled as clean as if the job had been let to government contractors; cornfields were left as bare as the highways, not a spear being visible; oatfields had a swath 30 to 80 rods wide swept away clean, the line of demarkation being as distinct as if done by machinery; Patrick A. Day and family, eight persons, found themselves safe on the kitchen floor, the only part of their roomy dwelling that remained; Mr. Lease was in the cellar, and looking up, found he had no house over him; Mrs. Lease caught up a child and opened the cellar door to seek a refuge, and found there was no cellar, the house being moved 10 or 12 rods from the cellar while she was going to the door; Mr. McConkey had three horses tied in his barn; the barn was torn to shreds and scattered in every direction, but the horses came from somewhere after the storm, without a scratch or wound. Just before reaching Sumner, in Bremer county, which is 18 or 20 miles from the origin of the tornado, the funnel cloud lifted and was dissipated, a fragment dropping down in Dayton township, south of Sumner, and destroying three or four barns. Relief corps were organized and timely assistance rendered those who were mostly in need of it."

The *Waverly Republican* sent its regular Tripoli correspondent, Mr. S. P. Hale, over the track of the tornado to verify the reports and ascertain the damage done. From his report the following additional facts are taken:

"The storm first struck Bremer county at the extreme northwest corner of Frederika township, bearing southeast in its course. A huge black and green cloud advanced from the north against a south wind. Just before it struck, the south wind yielded, and all was as calm as a summer evening. Then on came the storm. It first caught the residence of John Ager, who

resides on the county line, and hurled all of his buildings out of existence. When the family became conscious they were out in the door yard in a terrible rain storm. One little boy had his shoulder blade broken. Estimated loss, \$500. Next, it struck George Howard's and cleared off all his buildings and carried away a bobsleigh and lumber wagon; loss, \$300. Next came Joseph Hagedorn, barn 36x70 and 16-foot posts, completely ruined; cost, \$1,500; cyclone insurance, \$1,000; his house was damaged to the extent of about \$200; covered by cyclone policy; his wind-mill, machine house, 200 bushels of oats, 10 tons of hay and 120 chickens were all destroyed; total damage, \$2,000. From here it struck Ed. Burke's two-story house, 14x18, took off the south half of the roof and completely unroofed the L, which was 14x24. The storm took away the porch on the east side of the L. His barn, 16x24, with 16-foot posts, was entirely destroyed; also the granary, containing 250 bushels of oats, 50 bushels of wheat and 250 bushels of corn; loss, \$2,000. It next took a straight easterly course to Jim Brodie's farm, where it demolished a barn, 16x24, with 16-foot posts, and a kitchen, 12x14; loss, \$500. Taking a southeasterly course from here it made havoc with a fine belt of timber and reached the farm of Patrick O'Day, one of Bremer county's pioneers, where it completely destroyed Mr. O'Day's residence, a large horse barn, cow barn, hog house, two wind-mills and two tanks, and several other outbuildings, together with bedding, clothing, a \$175 organ and other furniture and seventy-five acres of fine young timber. He reports one horse killed and seven others injured; one cow killed and seven others missing. Everything is a total wreck. There was in the kitchen a family of eight, who escaped without serious injury. Mr. O'Day estimates his loss at \$6,000.

Next in line was the residence of Owen Marsh, which was carried about twenty rods into Fay's grove and totally destroyed. Mrs. Marsh, mother of Owen Marsh, received injuries from which she died in a few hours. She was severely cut about the head and injured internally; she was 70 years of age. All of Mr. Marsh's outbuildings were swept away and all furniture and clothing destroyed; loss, estimated, \$700. The barn of Edson Fay was next destroyed, leaving nothing but the floor, but the house, twenty rods to the east, was left untouched. His nice grove of evergreens and pines were left in a sad plight also. Here the wind tore up large oak trees by the roots, eighteen inches and two feet through at the butt. Mr. Fay's loss will reach \$1,000. J. J. McConkey, who had just finished and furnished a first-class farm house with all modern improvements, was the next visited. His house, a large barn, new wind-mill, granary, hog house, corn crib, bedding, clothing and furniture were entirely ruined; estimated loss, \$5,000. A piece of timber, 8x8 and 12 feet long, was carried from this barn 100 rods into a field and driven seven feet, endwise, into the ground. A door knob and a piece of the cook stove were found about eighty rods from where the house stood. The fine residence of W. B. Barnes was next blown into pieces, and the trees in the yard look as though they had been felled by the woodman's ax. His kitchen and one bedroom were removed from the main building and the roof on the L torn to pieces. Eighty bushels of wheat were strewn all over the pasture. His horse barn, cow barn and hog pen are demolished, his orchard ruined and top buggy smashed. Others of his neighbors to the east were similarly robbed of their buildings."

Observer J. O. Gwynn, of Davenport, reports a very heavy rainfall at that place on the night of the 22nd and morning of the 23rd, the measurement being 3.34 inches, resulting in damages estimated at \$9,000.

## JULY.

**BAROMETER.** Mean atmospheric pressure, 30.021 inches; highest observed, 30.477 inches at Clinton on the 6th; lowest, 29.580 inches at Cedar Rapids on the 2d. Range, 0.897 inches.

**TEMPERATURE.** The monthly mean for the State, 73°, was about one degree below the normal for July. The average for the first half of the month was unseasonably low; but the heated term from the 18th to the 28th brought the temperature up to about its normal value. The high temperature and large percentage of humidity made the warm period very oppressive, resulting in damage to the small grain crops. The highest temperature reported was 104° at Glenwood on the 11th; lowest, 38° at Centerville on the 1st.

**PRECIPITATION.** The rainfall for the State was 5.29 inches—about one inch above the normal for July. The maximum amount reported was 12.86 inches at Corydon, and the lowest amount 1.71 at Carroll. Thunder storms and hail storms were frequent.

## OBSERVERS' NOTES.

*Alta.*—DAVID E. HADDEN. A hail storm south and southwest of Alta did much damage to growing crops on 14th. Beautiful sunset on evening of 14th after a severe local storm, the clouds and sky in eastern portion were of all hues from deep crimson, red, yellow, orange, sea green, deep blue, pink, and many other shades, making a singularly beautiful appearance.

*Elkader.*—G. A. FAIRFIELD. Very peculiar and beautiful northern lights were visible on Wednesday evening, the 18th. Delicate belts of spiral, billowy light moved quite rapidly across the heavens, from east to west, while low down in the north the pale aurora borealis displayed its feeble disc. A brilliant meteor was observed to take a tumble out of the eastern sky on Monday about 8:30 P. M. When almost to the earth it seemingly broke in several parts, like the concluding performance of a gigantic Roman candle, affording an exceedingly beautiful spectacle.

*Keosauqua.*—JNO. H. LANDES. Some damage was done in the county by lightning, several houses being struck and five head of horses killed for one man and three head of cattle for another. On the evening of the 16th there was the finest auroral display that perhaps ever has been witnessed in this place, starting with a well defined arch of a yellow color, below which there appeared a dark cloud, from which beams of varied and brilliant colors shot up to an altitude of about 45°, with beautiful wavy and flickering motions. The brilliant phases increased towards the west, where were seen nearly all the colors of the rainbow.

*Larrabee.*—H. B. STREVER. On July 23d lightning struck one house and a barn, at the latter place killing two horses. A very peculiar aurora observed on 16th. A clearly defined band of bright light crossed the sky from east to west, while at its apex another white band curved from north to south at right angles. The edges of these bands were as clearly defined



as though cut with a knife, and on the background of the blue sky made an awe-inspiring spectacle.

*Williams.*—MERTON L. FULLER. 2.48 inches of rain fell in about seven hours on the 1st and 2d; several persons injured and some stock killed by lightning. A brilliant display of aurora borealis on the evening of 16th started as a bright light in north and northeast, and gradually assumed streamer shape which stretched from 40° to a point south of the zenith. These pillars moved from west to east with a speed of rapidly moving cirrus clouds. A distinct fog bow on forenoon of 17th.

*Cresco.*—GREGORY MARSHALL. Brilliant displays of aurora on 13th and 16th, brightest in northwest, and streamers extended to zenith.

*Clarinda.*—A. S. VAN SANDT. On 31st .54 inches of rain fell in fifteen minutes while the thermometer fell 14° in same time.

*Amana.*—C. SCHADT. Brilliant auroras on 13th, 16th and 25th.

*Delaware.*—WM. BALL. Warm weather of past week has brought corn forward until it is now nearly as far advanced as usual at this time of the year.

#### JULY STORMS.

Our special reports indicate an unusual number of severe local storms in this State during the month of July.

Observer J. S. Whittaker, of Corydon, reports an excessive downpour on the night of July 1st, the measurement at 10 A. M. of the 2d showing a total of 6.15 inches, the most of which fell in four hours, causing damage to bridges and crops.

Observer M. V. Ashby, of Afton, notes electric and wind storm on the night of July 1st, with a total rainfall of 2.25 inches. This was part of the general disturbance covering considerable portions of the State on the 1st and 2d.

Observer A. O. Price sends clippings from Iowa City papers giving some accounts of a so-called "young tornado" (wind squall) that swept through that city on the 2d. Some damage was done to roofs, window glass and light structures.

James Rodgers, of Blakeville, reports very heavy storms on the 2d and 3d, but no material damage resulted.

Observer F. J. Walz, of Davenport, sends a clipping from the *Daily Democrat* of that place, giving details of what is described as the most terrible wind and rain storm that ever occurred in Scott county, which occurred on the afternoon of the 2d. The northern part of Pleasant Valley and Davenport township appear to have been in the track of the heaviest blow. The account of damage resulting and the width of the disturbance, indicate that it was a very severe squall and not a tornado. No lives were lost, but the damage to trees, barns and other light buildings was quite heavy within its pathway.

Observer H. D. Olds, of Cedar Rapids, reports storms on the 18th, 20th and 21st. Of the first he says it was a thunder shower which developed into a small sized tornado, passing over the city, but not low enough to strike buildings. The lower end of the whirling funnel came no nearer the earth than the lower or drift stratum of cloud. Any detached cloud coming in the vicinity of the swiftly revolving funnel was quickly drawn in. On the

20th a thunder shower, with considerable wind, broke many shade trees and telegraph poles, and damaged the nearly ripened grain of the country. On the 21st a severe thunder shower with heavy rainfall beat down the grain and did much damage.

Hon. J. G. Brown, of Marshalltown, reports a severe wind storm on the 14th, which laid the small grain and corn low for a breadth of about 6 miles. The corn and grain mostly straightened up within three days. A new barn was completely demolished, and a wind-mill tower was wrecked; besides some minor buildings were destroyed.

The Dubuque *Telegraph* reports a very heavy electric and rain storm on the 14th. A number of losses of stock by lightning and damage to crops by heavy rain resulted.

Wm. A. Cook, of Washington, gives brief detail of a heavy wind storm which occurred at that place on the morning of the 20th, resulting in the unroofing of a two story brick building.

A severe wind storm occurred at Hiteman, Monroe county, on the 21st, and the newspapers reported it a tornado which had destroyed most of the town. Mr. Richard Phillips kindly gave us the details, and his report shows that it was a wind squall of sufficient force to destroy small and frail structures in its pathway; but it was evidently not a tornado. The damage was not heavy in the aggregate, and no lives were lost, though there were some narrow escapes. Mr. Phillips closes his account by saying: "No human being was hurt, but scores of them were scared almost to death, and among them was the writer."

A. W. Lewis, of Murray, says a severe electrical and wind storm visited that section on the night of 21st and morning of 22d. Two large barns were burned, in one of which was a horse. One man lost twelve head of cattle by lightning, and another lost two.

C. Chas. Larrabee, of Clermont, reports a severe thunder storm on the 24th. Lightning struck the Catholic church tower, and the residences of C. F. Becker and W. A. Wickham. Damage not heavy.

J. M. Elder, of Concord, reports a severe electric storm on the evening of 27th. A child of 10 years, named Esther O'Brien, was killed by lightning, about 4 miles northeast of Garner.

The following from the *Algona Republican* of the 27th relates to a heavy storm that passed through the northern part of Kossuth county on the 25th:

"The crops have been threatened considerably by hail and wind lately, but have escaped with very small damage in this vicinity. We learn that a severe wind and hail storm brushed the northern edge of Kossuth county, and swept the country about Elmore, Minnesota, on Monday morning last. One man lost his entire crop by the hail and his four horses by lightning. Two cars were blown from the track and the windows of the coaches smashed. The storm here was only sufficiently severe to make some people shake in their boots, and thank fortune when it was over."

W. S. Nicholson, of Willow Creek, Clay county, reports a small "twister" in Lincoln township, which damaged buildings to the amount of about \$500.

The Stanton *Call* reports a number of losses by lightning in that vicinity from the effects of a storm on the 21st.



## AUGUST.

**BAROMETER.**—Mean pressure for the month, 30.001 inches; highest observed, 30.28 inches, on the 19th at Omaha, Neb.; lowest observed, 29.66 inches, on the 8th, at Omaha, Neb., and Sioux City; range for the State, 0.62 inches.

**TEMPERATURE.** The monthly mean temperature for the State was  $71.4^{\circ}$ , which is about the normal for August. At the Mississippi valley stations it ranged from one to two degrees higher than in the interior and western districts. Light frosts occurred on the mornings of the 30th and 31st, but no material damage resulted except to corn in low places in the northern districts. The highest temperature reported was  $102^{\circ}$  at Atlantic and Glenwood on the 8th; lowest,  $40^{\circ}$  at Ames on the 31st. The range for the State was  $62^{\circ}$ .

**PRECIPITATION.** The average rainfall was 2.24 inches, which is 1.36 inches below the normal. The greatest amount reported was 4.69 inches at Larrabee; least amount, 0.65 at Maxon. Thunder storms occurred in localities on the 4th, 5th, 8th, 9th, 12th, 13th, 15th, 20th, 21st, 22d, 23d and 24th. Hail at Alta and Larrabee on the 8th, Murray and Richland on the 9th, Vinton on the 31st.

## OBSERVERS' NOTES.

*Blakeville.*—JAMES RODGERS. Fine weather in August for haying and harvesting. Corn on dry ground is doing well, and will make a fair crop if we have no early frosts. Had twenty days of sunshine this month, four days stormy, and the rest more or less cloudy. Wind northwest and southeast in nearly equal proportions. Rainfall, 2.80 inches.

*Monticello.*—HENRY D. SMITH. The maximum temperature for August since 1854 was  $98^{\circ}$  in 1854; minimum,  $36^{\circ}$  1863; normal for the month,  $70.02^{\circ}$ . Rainfall, maximum, 8.50 inches in 1855; minimum, 0.22 in 1889; normal rainfall, 4.00 inches.

*Grand Meadow.*—F. L. WILLIAMS. The month averaged warm, but the nights were cool. A light frost occurred in some localities, but none at this station.

*College Springs.*—A. A. BERRY. The first part of the month was unusually warm, and in some localities the drought was severe. The late rains have revived pastures and stock is doing well. An immense crop of hay has been secured. If frost holds off a month will have a fair crop of corn. Fall wheat yields enormously, and a large acreage will be sown this fall.

*Clarinda.*—A. S. VAN SANDT. On the 29th, at 2:30 A. M., the U. P. church in Clarinda was burned by lightning; loss, \$3,000. A barn four miles southwest was burned, with three horses and all the hay and grain.

*Clinton.*—DR. LUKE ROBERTS. The temperature for August was  $1.8^{\circ}$  above normal. But two years out of the last fourteen have been warmer, viz.: 1881 and 1886—the former  $2.9^{\circ}$  and the latter  $1.5^{\circ}$  above August, 1892. The coolest August during fourteen years was in 1885, being  $4.2^{\circ}$  below the last August. The month was notable for clear skies, the percentage of cloudiness being only 21, and no full cloudy day. The rainfall was little below the normal, but it was sufficiently abundant, together with plenty of

sunshine and warmth, to make the most favorable condition for good pasturage and the maturing of ungathered crops. All grains will yield much below an average, but there are some fields of corn that are gratifyingly good. The only fear now is an early frost. The month was barren of phenomena.

#### SEPTEMBER.

**BAROMETER.** The mean atmospheric pressure for the month was 30.05 inches. Highest observed, 30.349 inches, at Cresco, on the 1st; lowest, 29.712 inches, at Sioux City, on the 21st. Range, 0.637.

**TEMPERATURE** The temperature during the first half of the month of September was slightly below the normal, but the latter half was phenomenally warm and dry, making the month as a whole exceptionally favorable for maturing the corn and other belated crops. The mean temperature for the State,  $64.7^{\circ}$ , was about two degrees above the normal for the month. There have been but two warmer Septembers within the past ten years, viz.: in 1884 and 1891.

**PRECIPITATION.** The average precipitation was 1.53 inches, which is about 2.17 inches below the normal. Greatest amount reported, 4.15 at Delaware; least amount, 0.16 inch at Ames. There were no severe or destructive storms. Thunder storms occurred on the 3d, 6th, 7th, 8th, 9th, 10th, 11th, 17th, 21st, 22d, 23d, 25th, 26th, 27th, 28th and 30th. Hail was reported at Cedar Rapids on the 7th; Amana, College Springs, Independence and Panama on the 8th, and at Monticello on the 9th.

**LIGHT FROSTS.** On the 1st, 3d, 5th, 6th, 13th, 14th, 15th and 17th.

#### OBSERVERS' NOTES.

*Bonaparte.*—HON. B. R. VALE. The 3.40 inches of rain reported at this point was not general. It has been a dry month, to the benefit of corn and the detriment of pastures. A good acreage of wheat has been sown, but much of it has a poor seed bed.

*Mechanicsville.*—J. W. HUBBARD. A warm, dry month, favorable for threshing. Grain is light; corn about two-thirds of an average crop; potatoes light; buckwheat fair; oats about two-thirds of a crop.

*Monticello.*—HENRY D. SMITH. The maximum temperature for September since 1854 was  $98^{\circ}$  in 1854; minimum,  $26^{\circ}$  in 1871 and 1888. Normal for the month,  $61.4^{\circ}$ . The maximum rainfall was 10.75 inches in 1881; minimum, .00 in 1871. Normal, 4.07 inches.

*Williams.*—M. L. FULLER. This has been the driest September in six years. On the evening of the 21st thunder showers, with some hail, passed north of this station. Light frost on the 16th; no damage except in spots.

*Clinton.*—LUKE ROBERTS, M. D. The season is now so nearly at its close that we may venture a statement as to results of farming in this county. While grain of all kinds, grass, fruit and vegetables differ largely in each township and field, the average of all these products, compared with a series of years, will be found to equal about two-thirds, both in quality and quantity. The hay crop is much above that figure, while the apple and cherry crops went far below; oats are generally light in weight; potatoes not good; pasturage has been good all through the season; corn, in any given quality, if not quantity, may be taken from the same field; some fields will only fur-

nish fodder, while others will make their owner put on a pleasant, cheerful countenance. September precipitation was very light, being only 1.20 inches. With the exception of September, 1891, this was the least September rainfall in fourteen years. We are now in need of rain, although no serious results have yet caused complaint. The monthly mean temperature was slightly above normal. Of phenomena of a meteorological character, we had less than half a crop. One stray meteor, and that looked lonesome, was all we were treated to. No aurora, no comets, no startling thunder and lightning, no wind storms, no floods, and even frost was denied us.

*Cedar Rapids.*—H. D. OLDS. Weather fine and warm at close of the month. Corn is out of the way of the frost, and rain is needed. No frost as yet to injure vegetation.

*Fort Dodge.*—R. W. BLAIN. All corn is past danger of frost. Oats nearly all threshed with an average of 25 bushels per acre. In the month of September there were 17 clear days, 7 fair and 6 cloudy. Wind blew from the south 22 days, northwest 6 days, and northeast 2 days.

#### OCTOBER.

**BAROMETER.** The mean atmospheric pressure for the month was 30.07 inches. The highest observed corrected reading was 30.45 inches, at Clarinda on the 23d and at Omaha on the 25th. Lowest, 29.65 inches, at Davenport on the 28th. Range, 0.79 inch.

**TEMPERATURE.** The month was warm, fair and dry, with more than an average amount of sunshine. The mean temperature of the State, 54.5°C, was about 5° above the normal for October. The highest monthly mean was 60.5° at College Springs, and the lowest 47.5° at Williams. The highest temperature reported was 95° at Atlantic on the 1st, and the lowest 14° at Atlantic on the 25th, giving a range of 82°.

**PRECIPITATION.** The average precipitation was about 1.55 inches, which is about 1.80 inches below the normal. The greatest amount reported was 2.58 inches at Maxon, and the least amount .00 at Bancroft. There were 17 days of cloudless weather.

The drought was injurious to pastures and fall grain, but it was favorable for drying out corn and harvesting the crop in the best condition. Thunder storms were prevalent in localities on the 10th, 18th, 14th, 17th, 30th, 31st. There was a hail storm at Independence on the 31st.

**KILLING FROSTS** were general on the 8th, 9th, 19th and 20th. First ice reported on the 9th.

#### OBSERVERS' NOTES.

*College Springs.*—A. A. BERRY. A very dry month, with only one good rain, but it was a good one, putting the ground in good shape for finishing fall wheat seeding. Fully one-third more fall wheat has been sown than any previous year, and most of it is up and looking well. Corn husking just begun; it is not yielding as well as was expected. A great many cattle are being fed; hogs are scarce.

*Mechanicsville.*—J. W. HUBBARD. The surface of the ground is very dry. Frosts held off remarkably. Fall feed is scarce, but rank marsh grass grown on uplands will keep.

*Monticello.*—HENRY D. SMITH. On the 20th wild ducks were observed. The maximum temperature for October since 1854 was 88° in 1882; minimum 8° in 1887. The highest mean for the month was 58° in 1879; minimum 36 in 1873. The normal mean is 49.54°. The greatest amount of rainfall since 1854 was 7.21 inches in 1881; minimum, 0.48 in 1872; normal for the month, 2.93 inches.

*Van Buren.*—HON. B. R. VALE. A very dry month, following a dry September matured the corn, but cut potatoes badly. Many have fed stock for a month. Very little fall plowing done, except what was sown to wheat. The crop is looking well, considering the long drought. Corn husking begun.

*Fort Madison.*—MISS L. A. MCCREADY. This has been a dry month, pastures and everything drying up. Potatoes have been a failure, but corn is better than expected.

*Oskaloosa.*—JOS. BOYD. October has been a very pleasant month, with an unusual amount of sunshine and mild weather.

*Sidney.*—G. V. SWEARINGEN. The weather was clear to the 17th; cloudy and clear since, sunshine predominating.

*Cedar Rapids.*—H. D. OLDS. The first killing frost came on 28d, and ice formed on the 24th. A river gauge was placed in the Cedar by Dr. Geo. M. Chappel, and the first reading was taken October 19, 1892. The water was 0.50 of a foot above the zero of the gauge. The water was 0.85 foot above at close of month.

#### NOVEMBER.

**BAROMETER.** The mean atmospheric pressure for November was 30.11 inches. The highest observed was 30.63 at Cresco and Grinnell on the 6th; lowest, 29.31 inches at Dubuque on the 17th. Range, 1.32 inches.

**TEMPERATURE.** The mean temperature for the month, 38.3°, was about one degree below the normal. The month was generally fair, with more than an average amount of sunshine. The highest monthly mean was 39.8° at Richland; lowest, 26.5° at Carroll. The highest temperature reported was 70° at Glenwood on the 12th; lowest, 8° below at Charles City on the 23d.

**PRECIPITATION.** The average amount of precipitation was 1.10 inches which is .66 of an inch below the normal for November. Keokuk reported 3.16 inches and Sidney only 0.05. Snowfall generally very light. The month was favorable for corn husking and other farm work.

Thunderstorms were reported at Ft. Madison, Fairfield and Keokuk on the 27th. Sleet was quite general over the State on the 24th and 25th. The first snow fell at Alta on the 2nd.

#### OBSERVERS' NOTES.

*Clinton.*—DR. LUKE ROBERTS. November, 1892, came in with a continuation of rain which commenced in the early morning of the day previous and ceased at midnight of the 1st. Cloudiness continued and was a leading phenomenon of the month. But five clear days were manifest during the month, and one of these furnished a small per cent of cloudiness. A higher per cent of cloudiness prevailed during this month than for any November during the last fourteen years. The mean per cent of cloudiness for this

period was .51—.11 per cent less than for November, 1892. The first 4 days and the last 6 days of the month were entirely overcast. The clear days were the 5th, 8th, 10th, 21st and 23d.

The comet excitement which prevailed during the latter half of the month produced no serious mental derangement so far as I have learned, although timid people manifested much uneasiness. The cloudiness which prevailed during the last six days prevented any alarming results growing out of superstitious influences. On the evening of the 23d there was a partial clearing away of clouds and innumerable youthful meteors dodged through the rents, to the great delight of those who were fortunate enough to witness them.

*Alta.*—D. E. HADDEN. A fine display of shooting stars (Bielas) was observed on evening of 23d, averaging about 800 per hour, between ten o'clock and midnight. Radiant Andromeda principally, and some from Casseopeia.

*College Springs.*—A. A. BERRY. A very dry month with beautiful weather. Corn all husked and many farmers plowing. Fall wheat looking well, but in need of rain or snow before winter sets in. Corn turned out better than was thought for at first. Corn planted June 10th yielded 50 bushels per acre.

*Bonaparte.*—HON. B. R. VALE. On the 17th inst. we had a local snow storm from the northeast accompanied by very high wind. The snow contained the largest percentage of water I ever witnessed. The weight broke down all standing corn, weed patches, many ornamental trees and many branches from large trees—just pure snow—not sleet or ice. Six inches of snow fell making 1.05 inches of water.

#### DECEMBER.

**BAROMETER.** The mean atmospheric pressure was 30.17 inches. The highest observed was 30.70 inches at Clarinda on the 21st; lowest, 29.85 inches at Keokuk on the 7th.

**TEMPERATURE.** The monthly mean temperature was 18.9°, which is 4.6° below normal, making it the coldest December since 1886. The highest mean, 28°, was recorded at Fort Madison; lowest, 12.4°, at Williams. The highest temperature reported was 68° at Emmetsburg on the 2d, and the lowest was 29° below zero on the 20th. The range for the State was 97°.

**PRECIPITATION.** The average for the State was 1.65, which is the normal amount for December. The greatest amount reported was 3.04 inches at College Springs; least amount 0.20 inch at Sioux City. The average number of cloudy days was 13½.

#### OBSERVERS' NOTES.

*Alta.*—D. E. HADDEN. On December 4th aurora observed 8 P. M., in full moonlight; very bright in north and northwest. Numerous bright green beams and streamers reaching nearly to the zenith and changing to a deep garnet color at 8:05, also reaching nearly to the zenith—finally changing to yellow. The meteor continued until nearly 2:00 A. M., but faintly maximum brightness between 8 and 9:30 P. M.; and the chief seat of activity was northwest; the streamers, when at an altitude of 45 degrees, seemed to converge in a westerly direction.

*Ames.*—(4 miles southwest of) ISAAC YOUNG. Following is a summary of precipitation for the year 1892: January, 3.25 inches; February, 0.60; March, 1.95; April, 4.00; May, 9.45; June, 8.12; July, 8.07; August, 2.58; September, 0.15.

*Fort Dodge.*—R. W. BLAIN. The month of December brought no severe storms or sudden changes of temperature, and was favorable for the care of cattle. There were sixteen cloudy, seven fair and eight clear days. Snow fell to the depth of nine inches on the 7th. The highest temperature was 49°, at 1:00 P. M., on the 4th. The lowest, at 7:00 A. M., was 12° below zero on the 26th. Prices of farm products are fair, and farmers are feeling satisfied.

*Knoxville.*—C. G. BROBST. Following is a record of weather at Knoxville for December, 1892, compiled from observations at 7 A. M. by C. G. Brobst, and published in the *Journal* of that place: October, 1.20; November, 0.55; December, 1.35. Total for the year, 36.27 inches.

*Cedar Rapids.*—H. D. OLDS. The present fall of snow began on December 13th and the ground has since been covered, more or less snow falling at different times since. The thermometer registered lower last December than it has for eight years. In 1886 the lowest temperature recorded was 20° below, on the 27th day of the month, and the lowest since that time was 12° below, last month. Following is the official report of the weather for last month with comparisons:

Mean barometer for month of December, 1892, 30.151; average mean barometer for month of December for eight years, 30.097; highest temperature for December, 1892, 44°; lowest temperature for December, 1892, 12°; mean temperature for December, 1892, 21.3°; average mean temperature for December for eight years, 26.4°; lowest December temperature in eight years, 20°, in 1886; precipitation for December (rain and melted snow), 1892, 2.02 inches; mean precipitation for December, for eight years, 1.70 inches; snowfall for December, 1892, 5.59 inches; average snowfall for past eight years in December, 5.45 inches.

*Storm Lake.*—A. J. BOND. The ground has been fully covered with snow since the 7th, with very little drifting. Roads good for wheels or runners.

*Oskaloosa.*—JOSEPH BOYD. Winter wheat did not look very well when winter set in; too dry. Stock of all kinds doing well.

*Fort Madison.*—MISS L. A. MCCREADY. Mississippi river closed on the 20th.

*Carroll.*—MOSES SIMON. Finest sleighing for years.

*College Springs.*—A. A. BERRY. From the 7th the month has been a "tearer." Sleighing never better. The ground was not frozen when the snow fell, and the covering will be the very best thing for fall wheat.

#### ANNUAL SUMMARY.

**BAROMETER.** Mean pressure for the year, 30.060 inches; highest observed, 30.819 inches, on March 27th, at Grinnell; lowest observed, 29.110 inches, on April 10th, at Sioux City; range for the State, 1.739 inches; average monthly range, 1.086.

**TEMPERATURE.** Mean temperature for the year, 47.1°; highest temperature reported, 104°, on July 11th, at Glenwood; lowest, -38°, on January 19th, at Atlantic; range for the State, 142°; average monthly range, 54.5°.



**PRECIPITATION.** Average for the State, 87.12 inches; the greatest monthly rainfall reported was 14.16 inches, at Dubuque, in June; the least was .00 inch, at Bancroft, in October; the greatest amount reported for any twenty-four consecutive hours was 6.19 inches, at Corydon, on the 1st and 2d of July.

**WIND.** Prevailing direction, northwest; maximum velocity reported was 64 miles an hour, from the southwest at Des Moines, on April 1st.

There were 146 clear days during the year, 102 partly cloudy, 117 cloudy, and 87 days on which .01 inch or more of precipitation fell.

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### JUNE CROP REPORT.

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#### SHOWING THE ESTIMATED ACREAGE AND AVERAGE CONDITION OF THE STAPLE CROPS, JUNE 1, 1892.

The months of April and May were abnormally cold and wet, and on the 1st of June the season was three to four weeks late in respect to seeding and planting. Grass and winter grain had made a fair average start, and foliage and blossoms were not more than fifteen days later than usual, but the conditions were unfavorable for field work. At the close of May only a small percentage of the average acreage of corn had been planted, and a considerable portion of the seed failed to germinate because of the prevalent wet and cold weather.

As a result of these untoward conditions the correspondents of this Bureau have been unable to make satisfactory reports of the acreage and conditions of corn, potatoes, flax, etc. This will necessitate a revised report of the acreage of these belated crops, which will be included in the July issue. Meantime we give herewith the tabulation of the June estimates for what they are worth, with the stipulation that the figures are subject to future correction.

Compared with last year there appears to be a decrease in the acreage of winter and spring wheat, corn, oats, rye, barley, flax, broom corn, sorghum and potatoes. An increase is reported in the area of timothy, clover and millet.

**WINTER WHEAT.** The reports indicate a decrease of 3 per cent in the acreage of winter wheat. The condition of the crop is averaged at 86 per cent, which is a fair showing after the close of an open winter, and considering the adverse conditions at seed time.

**SPRING WHEAT.** There appears to have been a reduction of 6½ per cent in the acreage of this cereal, compared with 1891, and its condition is rated 88 per cent. The U. S. census report showed that the total area of winter and spring wheat in Iowa, in 1889, was 578,729 acres. On this basis our estimate of the present acreage of winter and spring wheat is 538,218. With favorable conditions the yield will be about 8,500,000 bushels.

**CORN.** The estimates of correspondents indicate a decrease of 17½ per cent in the acreage of corn, compared with last year. This is certainly a

conservative estimate of the effects of floods and other adverse conditions during the planting season. Our opinion is that the revised reports later in the season will show a decrease of at least 20 per cent in the area actually planted under conditions to insure a fair crop. And considering all circumstances attending the planting, the condition of soil, and the pressure of other work which will necessitate spare cultivation, the present outlook is that the corn product of Iowa will this year not exceed 70 per cent of the total yield in 1891. The area planted in 1889, according to the census of 1890, was 7,585,522 acres. After the July report an estimate can be made of the acreage of 1892, and its relative condition can then be more accurately determined.

**OATS.** The reports show a decrease of 11 per cent in the acreage of oats, compared with last year, and the actual reduction is likely to be greater rather than less than the percentage named. The U. S. census reported the area of this cereal in Iowa, in 1889, to be 8,752,141 acres. Taking that as a basis, the present number of acres is 8,839,406. The condition of the crop is averaged at 82 per cent.

**RYE.** There appears to be a decrease of 8 per cent in the acreage of rye, and its condition is placed at 91 per cent. The present area, on the basis of the U. S. census, is 86,211 acres.

**BARLEY.** The acreage of barley, according to the reports, is substantially the same as last year, the average decrease being only  $\frac{1}{4}$  per cent. The condition of this cereal is averaged at 89 per cent. The total area in 1889 was reported to be 578,729 acres.

**FLAX.** The reports show a decrease of  $7\frac{1}{4}$  per cent in area sown to flax, and the condition is placed at 86 per cent. The present area appears to be about 273,513 acres.

**TIMOTHY AND CLOVER.** There appears to have been an increase of 6 per cent in the acreage of timothy and clover, and the season has been favorable to these forage plants. The condition of timothy is 104 and clover 101 per cent. The present estimated area is a little over three and one-half million acres.

**MILLET.** The fact that this forage crop may be sown late is the basis of the estimate that there will be a large increase in the acreage this year. Correspondents report an average increase of 18 per cent.

**BROOM CORN.** The estimated decrease in acreage is 18 per cent.

**SORGHUM.** There appears to be a decrease of 17 per cent in the area devoted to this crop.

**IRISH POTATOES.** The estimated decrease in the area of this crop is 12 per cent, from the same cause which affected corn. But since the reports were made the weather has favored late planting, and it is likely that the usual acreage may be shown by later advices.

**SWEET POTATOES.** There appears to be a decrease of 15 per cent in the acreage of this useful crop, and its condition is placed at 75 per cent.

**FRUIT.** From notes of correspondents it is apparent that the condition of fruit generally is much lower than last year at the same date. This is especially true of apples, plums, cherries, strawberries and currants.

**PASTURES.** The season has been especially favorable for grasses, and pastures are rated at 101 per cent.



**LIVE STOCK.** The condition of cattle is reported to be 96 per cent; sheep, 97; hogs, 97; the spring pig crop, 75; horses, 97, and foals, 90. The cold, stormy weather in April and May cut short the spring pig crop 25 per cent, it appears.

Condition of soil is rated  $72\frac{1}{2}$  per cent; and the latest frost reported was on June 1st, but no material damage resulted.

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## JULY CROP REPORT.

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### AVERAGE CONDITION OF THE CROPS JULY 1.

The July estimates of correspondents show a fair measure of improvement in the condition of the staple crops, compared with the report of June 1st, at which time very unfavorable weather conditions prevailed in all parts of the State. The first half of June was generally cool and wet, greatly retarding planting and cultivating; and in extensive portions of the State excessive rains continued at intervals till about the 25th of the month. Yet despite all drawbacks the present outlook encourages the hope that the labors of the husbandmen of Iowa will this year be fairly rewarded.

**WHEAT.** The reports show an improvement in the condition of winter wheat, the average being  $95\frac{1}{2}$  per cent as against 86 the first of June. The cool weather of the spring favored this cereal, and on well drained lands it has made a fair crop, and has been harvested in good condition. Spring wheat is averaged at 89 per cent, having only held its own.

**CORN.** The June report showed a decrease of  $17\frac{1}{2}$  per cent in the acreage of corn, compared with last year. As the season was very backward, not more than 50 per cent of the crop being planted before the 1st of June, a revised estimate of acreage was called for. The reports were evidently made with unusual care, and the average shows a present acreage of 85 per cent compared with 1891. That is certainly a liberal estimate, taking into account the immense area of flooded lands and the prevalent wet weather in the planting season. The census report shows that in the great corn year of 1889 Iowa planted 7,585,522 acres. It is probable that there was no material change in the area planted in the years 1890 and 1891. Assuming the census figures to be correct and that there was no change in the two following years, we have this year 6,446,694 acres in corn. The July condition of this crop is  $72\frac{1}{2}$  per cent. So the present outlook gives promise of about two-thirds of a full average yield.

**OATS.** This cereal is rated 83 per cent, as to condition, and the acreage is 88 per cent, or 12 per cent less than last year. The census report credits Iowa with 3,752,141 in 1889. Taking these figures as a basis this State has the present season, 3,301,885 acres.

**RYE.** This cereal averages 93 per cent in condition, and it has generally been harvested in good order.

**BARLEY.** The condition of barley is estimated at 89 per cent, substantially the same as in the June report.

**FLAX.** This crop is rated 90 in condition, and 89 as to acreage—11 per cent short of last year. The census showed that in 1889 we had 230,085 acres. The increase in '90 and '91 was sufficient to balance the decrease in '92, so the census estimate will stand.

**TIMOTHY AND CLOVER.** Timothy is estimated at 105 and clover at 108 per cent. This has been a great year for grass, and the hay harvest reports show a heavy yield. The present area is something over three and one-half million acres in meadows.

**MILLET.** The reports show an acreage of 120 per cent compared with last year, the large increase being due to the shortage of corn.

**BROOM CORN** is rated at 83 per cent, and sorghum 98.

**IRISH POTATOES.** The acreage of this crop appears to be 8 per cent short of last year, and the condition is 86 per cent. Sweet potatoes estimated at 87 per cent.

**PASTURES** are remarkably fine, the rating being 105 per cent.

**FRUIT.** Apples are variable, the range being from 35 to 112 per cent. The average is 64 per cent for the State. Other fruits are rated as follows: Pears, 52; plums, 45; grapes, 85; blackberries, 100; raspberries, 94, and strawberries, 82½.

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## SEPTEMBER CROP REPORT.

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### CONDITION AND YIELD OF THE CROPS.

As a result of the unfavorable conditions existing in the spring and early part of the summer, the products of Iowa farms, except as to grass and forage crops, will this season fall considerably below the average of recent years; but the final round-up will show an ample supply for all local wants, and prices are likely to favor the producers. Compared with the July report, there has been an increase of two points in the condition of corn, and a decrease in nearly all other crops. The following is a summary of the reports of 857 correspondents:

**CORN.** The acreage of corn planted this season, in comparison with last year, is estimated to be 85 per cent. The present condition of the crop throughout the State is 75 per cent, compared with the average of recent years. This indicates that the total yield, with favorable weather conditions until it is fully matured, will not exceed 64 per cent of an average crop. A killing frost before September 25th would quite materially reduce the output of merchantable corn. And at least 20 per cent of the crop will require all of September to ripen. The report by counties shows a very uneven condition, the estimates ranging from 48 to 100 per cent.

**BUCKWHEAT.** There was an increased acreage of this crop sown, and its present condition averages 92½ per cent.

**IRISH POTATOES.** The condition of this crop is exceedingly variable, ranging from 31 to 100 per cent. The average for the State is 62 per cent. The northern central district seems to have the highest averages.

**SWEET POTATOES.** The average of this crop is 74½ per cent.

**BROOM CORN.** This crop is raised in 62 counties, and the average condition is rated at 80 per cent.

**SORGHUM.** Average condition 79 per cent.

**APPLES.** The average of this important fruit crop is 48½ per cent. The reports by counties show a very wide range—the northern district making by far the best showing.

**GRAPES.** The average for the State is 83 per cent.

**MILLET.** This crop, with an increased acreage, is rated at 92 per cent.

**PASTURAGE** is averaged 93½ per cent, as against 105 in July.

#### AVERAGE YIELD PER ACRE.

**WHEAT.** Reports of threshing indicate an average yield per acre of 17½ bushels of winter wheat, and 13 bushels of spring wheat. If this average is maintained by later reports the total wheat crop of the State will be about 8,078,270 bushels. Our estimate in the June report was 8,500,000 bushels.

**OATS.** The average yield as reported by threshers is 25 bushels per acre, and it is generally below the standard weight. The present acreage is estimated to be 3,339,406, giving a total yield by measure of 83,485,150 bushels—or about 60 per cent of an average.

**BARLEY.** The average yield is 14 bushels and the acreage is 578,729 giving a total output of 13,889,496 bushels.

**RYE.** The reports of threshing show an average yield of 15½ bushels per acre, giving a total product of 1,357,823 bushels.

**FLAX.** The average yield is 7 bushels per acre, indicating a total of 1,914,591 bushels.

**CLOVER AND TIMOTHY SEED.** The estimated product of clover seed is 2 bushels and of timothy 4½ bushels per acre. But little threshing has been done as yet, and it is too early to make a final estimate.

**HAY.** The yield is averaged at 1½ tons per acre, which is a moderate estimate.

**HONEY.** Our reports rate the honey crop of the season at 86 per cent.

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### FINAL CROP REPORT FOR 1892.

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#### AVERAGE YIELD AND MARKET PRICES OF THE STAPLE CROPS.

The final crop report of the season fully sustains previous estimates. The total products of the soil this year fall considerably below the average of recent seasons, but the faithful husbandmen have received a fair measure of reward for their labors. The crop season was very late, and unfavorable weather materially lessened the acreage of corn and other spring crops. Considering all the untoward conditions attending the seeding and cultivation of crops, the total output secured is a notable illustration of the productive capabilities of Iowa's soil and climate.

**CORN.** The average yield of this staple crop for the State is shown by the report to be 29 bushels per acre, which is 9 bushels less than the estimated yield in 1891. The yield has been exceedingly variable, the county averages ranging from 20 to 36 bushels per acre. Even in the same localities the difference in yield was very great, in many cases ranging from 15 to 50 bushels. On well drained and fairly well cultivated lands, recently in clover or pasture, the best results were obtained.

The census of 1890 showed the corn area of 1889 to have been 7,585,522 acres. This season there was a notable decrease in the acreage planted, the reports showing an average shortage of 15 per cent compared with the average of recent years. That would indicate that the area planted this year was 6,446,694 acres. After planting there was still further reduction of acreage by excessive rains, resulting in abandonment of very many fields, or parts of fields. This loss is estimated at 7 per cent of the entire area planted. It therefore appears that the total area of corn worth the husking amounted to about 5,995,426 acres, giving a total product of 173,867,354 bushels. The average price, December 1st, was 82 cents per bushel.

**WHEAT.** The average of winter wheat is reported to be 17 bushels, and of spring wheat 12½ bushels per acre. The area in spring wheat is much greater than winter wheat, and the average is therefore placed at 14 bushels per acre. The wheat area, according to the census returns, deducting the decrease, was 538,218 acres, giving a total yield of 7,534,952 bushels. Average price, December 1st, 58 cents.

**OATS.** The average yield of oats is placed at 25 bushels per acre, and the quality is generally below the average. The estimated area this year, on the basis of the census returns, was 3,339,406 acres, indicating a total output of 83,485,150 bushels. Average price, December 1st, 27 cents.

**BARLEY.** Average yield, 24½ bushels per acre. Acreage, 578,729; total output, 14,049,072 bushels. Average price, 50 cents.

**RYE.** Average yield, 15½ bushels per acre. Acres planted, 86,211. Total yield, 1,536,270 bushels. Average price, 44 cents.

**FLAX.** Average yield per acre, 8 bushels. Acreage, 273,513. Total yield, 2,188,104 bushels. Average price, December 1st, 90 cents per bushel.

**BUCKWHEAT.** Average yield, 14½ bushels per acre. There was a general increase of acreage over any previous year, and the approximate area sown may be placed at 35,000 acres. This would give an output of 498,750 bushels. Average price, 61 cents per bushel.

**TIMOTHY SEED.** Average per acre, 4 bushels. The number of acres harvested for seed cannot be given with any degree of accuracy. It would be within the bounds of probability to place the total yield at 750,000 bushels. Average price, \$1.45 per bushel.

**CLOVER SEED.** Average yield, 2 bushels per acre. Acreage unknown. Average price, \$6.10 per bushel.

**IRISH POTATOES.** This has been a very short crop, the average yield being placed at 51 bushels per acre. The acreage planted was about 171,160 acres, and the total yield was 8,729,160, or less than one-third of the product of 1891. Average price, 73 cents per bushel.

**SWEET POTATOES.** Average yield, 57 bushels per acre. Acreage about 2,200; total product, 125,400 bushels. Average price, \$1.29 per bushel.

MILLET SEED. Average yield, 17 bushels per acre. There was an increase in acreage estimated at 20 per cent, but the total acreage is unknown.

BROOM CORN. Average yield, 2 tons per acre. Probable acreage, 2,020. Product, 4,040 tons. Average price, \$76 per ton.

HAY. Average yield, 14-5 tons per acre. The acreage of meadows, exclusive of prairie grass lands, is estimated at 3,349,000 acres. This would give a total output of 6,228,200 tons. Average price, December 1st, \$5 25 per ton.

SORGHUM. Average yield per acre, 81 gallons. Area planted, 17,876 acres. Amount produced, 1,447,956 gallons. Average price, 42 cents per gallon.

The average price of wool December 1st, was 20 cents per pound. Average price of milch cows, \$21.62. Average amount of fall plowing done, compared with recent years, 75 per cent.

GENERAL CROP SUMMARY, 1892.

PRODUCTS.	No. of acres.	Average per acre.	Total yield.	Value.
Corn.....	5,995,436	29	173,867,354	\$ 55,637,553
Oats.....	3,330,406	25	83,485,150	22,540,990
Wheat.....	538,218	14	7,534,952	4,370,272
Barley.....	578,728	24½	14,049,072	7,024,536
Rye.....	88,211	15½	1,536,270	675,956
Flax.....	273,513	8	5,138,104	1,969,293
Buckwheat.....	85,000	14½	498,750	304,237
Irish potatoes.....	171,160	51	8,729,160	6,372,286
Sweet potatoes.....	2,200	57	125,400	161,766
Timothy, clover and millet seed.....	.....	.....	.....	* 2,000,000
Broom corn (tons).....	2,020	2	4,040	307,040
Hay (tons).....	3,349,000	1 4-5	6,228,200	32,698,050
Sorghum.....	17,876	82	1,447,956	665,959
Pasturage.....	.....	.....	.....	* 35,000,000
Prairie hay and other forage.....	.....	.....	.....	* 6,000,000
Total value of soil products.....	.....	.....	.....	\$ 175,727,940

\* Estimated.

The above figures are believed to be approximately correct. The total value of soil products of Iowa farms, for the season, estimated at current market rates at points nearest the farms, appears to be \$175,727,940. These are the raw materials used by farmers for the production of beef, pork, mutton, horses, dairy and poultry products, etc, etc., in the manufacture of which there is a probable increment of profit above the present prices of the raw products of the farms. In estimating the value of pasturage there are no reliable statistics that may be used as a basis. But it is known that the pastures yield almost the entire support of the live stock of the State more than half the year, and with this we have a starting point in figuring

the value. It is quite certain that the pastures of the State, having an area more than four times as great as the meadows, are worth more in gross value than the tame hay crop, which is figured at over \$82,000,000. It is therefore deemed safe to place the value of pasturage at \$85,000,000, believing it is below rather than above the mark. In the above summary no account is made of the products of orchards, vineyards, gardens, etc., which would amount to a considerable item.

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## WEATHER CROP BULLETINS.

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### SUMMARIES OF BULLETINS ISSUED DURING THE CROP SEASON OF 1892.

#### BULLETIN No. 1. APRIL 9.

Compared with the average of the past fifteen years the season is about a week late; but the general conditions are more favorable than at the corresponding date last year.

The first half of the week was warmer than the average for the season, but freezing temperature prevailed the last three days. No especial damage, however, is likely to result. There was a general excess of rainfall throughout the State, which has delayed seeding, but the soil is well saturated at a greater depth than at any time within the past five years, and grass has made a fine start.

The acreage of winter wheat in this State, though increasing in recent years, is still relatively small. The reports indicate that in about two-thirds of the counties wherein it is grown its condition is fair, and in the other sections it is not promising. Winter rye is generally in good condition.

All kinds of live stock have come through the winter in excellent condition; there is an abundance of feed remaining in store, with the prospect of early pasturage. On the whole the outlook for the farmer is quite favorable.

#### BULLETIN No. 2. APRIL 16.

The past week was unseasonably cold and stormy. The average daily temperature was over 9° below the normal, and there was but little sunshine.

The storm which began Tuesday evening developed on Wednesday into a regular March blizzard of considerable severity, with rain, sleet, hail and snow, accompanied at times by lightning and thunder. In the northern half of the State the snow was quite heavy, and the drifts impeded railway travel. It was an unusual storm for the season, though not wholly unprecedented. The amount of precipitation varied from one-half an inch to over two inches. The temperature fell at the close of the storm a little below the freezing point.

The principal damage resulting was in delaying the necessary work of an already belated season, and in the loss of young stock not properly sheltered. Fruit is not sufficiently advanced to be injured.

Compared with the average of recent years the season is now fully two weeks late, or about as it was at the corresponding date last year. Spring

wheat is mainly planted, and the sowing of other small grain is, on an average, about half done.

The worst of the present outlook is that the weather is not yet settled, and the temperature is still unseasonably low. The soil is abundantly moistened, and only warmth and sunshine are needed to quicken vegetation and make the farmers happy.

The probability is that the untoward conditions will considerably reduce the acreage of all kinds of small grain. It is likely to be a very favorable season for grass.

#### BULLETIN No. 3. APRIL 23.

The weather conditions during the week have continued unfavorable for farm work or germinating of grain. The temperature has been exceedingly cold, averaging about seven degrees below the normal.

The precipitation has been above the normal in all sections of the State, except the northeastern portion, where it fell a little below the seasonal average; in the northwestern and southern portions it was excessive. Mr. A. W. Lewis, at Murray, Clarke county, reports a total for the week of 3.07 inches, 1.50 inches of which fell on Sunday in one hour and thirty minutes, accompanied by a heavy fall of hail. A severe snow storm prevailed in the north and western part of the State on the 20th.

The excessive amount of moisture has prevented farmers doing field work and but little, if any, advancement has been made since our last bulletin, but with the more favorable conditions at the close of the week and fair prospects of their continuance, every minute will be improved, seeding generally completed and plowing for corn will have begun before the close of the coming week.

Winter grain is reported as being in fair condition; oats rotting in several localities and grass starting slowly but thick, and with a few days of warm sunshine will make rapid growth.

#### BULLETIN No. 4. APRIL 30.

The past week brought slightly improved weather conditions for farm operations, but the average daily temperature was two to three degrees below normal. Compared with the average of recent years, the season is 15 to 18 days late. The total deficiency of temperature since March 1st is 152 degrees. There was a general frost on the morning of the 29th, but fruit is uninjured and the prospect is good.

Sowing of small grain is quite generally completed, but the unfavorable conditions have caused a heavy decrease in the acreage of oats, wheat and barley. This may result in a corresponding increase in acreage of corn, millet and flax, if the season becomes more favorable. There is some complaint of oats rotting in localities where there has been the greatest excess of moisture. Grass and winter grain are doing well.

Good progress has been made in preparation of corn ground, and planting will begin as soon as the weather will permit.

The amount of rainfall for the past week was generally below normal, and there was a deficiency of sunshine.



**BULLETIN No. 5. MAY 7.**

Reports from all parts of the State tell about the same story of cool weather, excessive rainfall, delayed farm work, and considerable damage by floods. Rain fell in nearly every county six days, and there was but one day of sunshine during the past week. The measurements of precipitation range from 1.50 to over 7 00 inches, and the average for the State was about 3.50 inches.

The acreage of oats and other small grain is greatly reduced compared with last year. Much corn ground is yet to be plowed, and it is probable that the lateness of the season and saturated condition of soil will cause a considerable decrease in the corn acreage.

Grass, winter wheat, and early sown oats are doing fairly well. Fruit prospects are very good.

**BULLETIN No. 6. MAY 14.**

Another cold and wet week must be added to the record of this unpropitious season. The daily average temperature was about 10° below normal, and the rainfall was generally in excess, ranging from 1 to 3 inches. There were not more than 12 hours of sunshine on the average during the week. As a result the crop situation is becoming serious in considerable portions of the State. Very little plowing has been done, and a bare beginning has been made in corn planting in the more favored localities. Farmers are idly waiting till the clouds roll by. In the western and southern districts, where the rainfall has been heaviest, the arable bottom lands are under water and the uplands are soggy with moisture.

Oats and other small grain crops on well drained fields are doing fairly well, but in low lands they are generally drowned out. And even with the most favorable conditions in the future there is no eminent danger of overstocking the markets with the cereal products of Iowa this year.

Grass is doing fairly well and fruit prospects continue good.

**BULLETIN No. 7. MAY 21.**

Another cold and wet week, with heavy local rains and destructive floods, deepens the gloom of the crop situation. The daily average temperature was over 5° below the normal, and on Friday snow flurries are reported from nearly all parts of the State. The heaviest rainfall occurred in the western, northwestern and north central districts, the following being some of the reported measurements: Cherokee, 4.86 inches; Monona, 4.10; Buena Vista, 3.96; Palo Alto, 3.95; Lyon, 3.92; Omaha, 3.66; Wright, 3.25; Adams, 3.18; Calhoun, 2.55; Pottawattamie, 2.50; Marshall, 2.69; Story, 2.50.

There were less than two full days of sunshine during the week. But little planting or other field work has been possible. Wheat and oats on uplands look fairly well; on low lands grain crops are drowned out or turning yellow. At the close of this week of disasters, some faint rainbow tints appear on the breaking clouds, and hope rises to renew the struggle against grim despair.

**BULLETIN No. 8. MAY 28.**

The daily average temperature of the past 7 days was about 6° below normal; but the rainfall was very light, and there has been more than the



usual amount of sunshine. This has given the farmers their first full week of fine weather for field work, and it has been faithfully improved. The inspiring click of the corn planter has been heard from daylight till dusk, making a fitting prelude to the harvest home and thanksgiving chorus which has never failed to be heard in Iowa every year since the prairie turf was first broken by the plowshare of civilized man.

Corn planting is fully half completed throughout the State at large, but it is probable that the total acreage will this year fall considerably below the average, even with the most favorable conditions in the future. Oats and wheat are doing well on upland fields, but on the flooded bottoms and undrained fields the yield will be very light.

Fruit has been slightly injured by cold winds and frost, but the prospects are generally good. Meadows and pastures were never better at this time of the year.

#### BULLETIN No. 9. JUNE 7.

The daily average temperature of the past ten days was about 5° below the normal, and there was much less than an average amount of sunshine. The rainfall was excessive in all parts of the State except the north central and northwestern districts. Following are some of the heavier measurements reported: Linn, 5.64; Jones, 5.60; Iowa, 5.15; Washington, 4.86, Cedar, 4.62; Johnson, 3.85; Delaware, 3.84; Davis, 3.02; Keokuk, 3.02; Dubuque, 3.55; Wayne, 3.00; Van Buren, 2.88; Montgomery, 2.89; Clayton, 2.75; Muscatine, 2.42; Clinton, 2.55.

In districts where the rainfall was light, corn-planting is practically completed, with a considerably decreased acreage as compared with last year. But in the larger parts of the State little progress has been made since the 27th ult. In the State at large it is estimated that about sixty per cent of the usual acreage of corn has been planted, and under the most favorable conditions in the future the acreage will not exceed eighty per cent of an average.

There are many reports of seed rotting, but it is probable that not more than the usual amount of replanting will be necessary from that cause. The weather is now more promising, and small grain crops are doing fairly well. Farm work is about four weeks late, and the hay harvest is likely to come on when teams and hands are needed in the corn fields.

#### BULLETIN No. 10. JUNE 14.

This has been a very favorable week for farm operations, and for all crops. The daily average temperature was about 3° above normal, with more than the usual amount of sunshine; and the rainfall was generally sufficient to keep the soil in good condition for vegetation.

Corn planting is nearly completed, and cultivation is in progress. The stand is about as good as in ordinary seasons, and not more than the usual amount of replanting is necessitated because of the poor seed and unseasonable weather. The acreage is materially decreased, but with seasonable weather a fair crop may be produced.

Small grain, meadows and pastures are doing well.

Late reports received by telegraph before going to press indicate that the showers on Monday were well distributed, doing much good in preventing baking of the soil.

## BULLETIN No. 11. JUNE 21.

The past week was generally favorable for farm work and for all crops. The daily average temperature was nearly 2° above normal; there was an abundance of sunshine, and in the larger part of the State the rainfall was barely sufficient for the needs of the growing crops. There are reports, however, of severe local storms, with excessive rainfall in the northeast district and in contiguous counties in the north central and east central districts; also within a small area in the south central district. Following measurements are reported: Dubuque, 5.22 inches; Clayton, 4.46; Howard, 3.07; Fayette, 2.87; Butler, 2.50; Muscatine, 3.37; Wayne, 3.65. In all these storms some damage was wrought by wind, lightning and floods.

In three-fourths of the State corn is doing remarkably well, and cultivation is in progress. Small grain generally promises well; but there are complaints of damage by rust in sections where there has been an excess of moisture and high temperature. Grass is very heavy in all districts, and clover cutting will soon begin.

## BULLETIN No. 12. JUNE 28.

The daily average temperature of the past week was slightly below normal; the first half being hot and the balance cool.

The rainfall was unusually variable, the measurements ranging from a quarter of an inch to nearly six inches.

The excessive downpours are reported from the northeast and east central districts. Following are some of the excessive measurements: Scott, 5.73 inches; Clayton, 5.52; Howard, 5.05; Dubuque, 5.24; Cedar, 4.69; Fayette, 4.29; Delaware, 4.29; Floyd, 3.52; Jones, 3.36.

In all these flooded districts crops were considerably injured, and corn is very weedy.

In the larger part of the State, however, the precipitation was below the normal and the weather was generally favorable for cultivation and for all crops. Clover is being cut in some of the southern counties and the harvest of winter grain will begin within the coming week. Corn is making rapid growth where conditions favor cultivation. Oats will average below the yield of recent seasons.

The Mississippi at Davenport is reported above the highest mark on record. The Cedar reached highest point of the year during the week. On the 22d a tornado was reported passing near Sumner in Bremer county, destroying buildings and killing five persons. This will be fully investigated.

## BULLETIN No. 13. JULY 5.

The weather during the past week was too cool for the rapid growth of corn, but the conditions were generally favorable for small grain. The daily average temperature was about six degrees below normal. The rainfall of the week was in excess of the seasonable amount, especially in the central, east central and south central districts.

Corn is about two weeks late, and needs warmer weather to mature. It is doing fairly well, and is generally clean where it has not been too wet to run the cultivator. With the most favorable conditions in the future it will be possible to make two-thirds of an average crop in the State.

Haying and the harvest of winter grain are in progress. The hay crop will be very heavy, but the quality will not be up to the standard. Oats will not make over 60 per cent of an average yield.

BULLETIN NO. 14. JULY 12.

The past week has been generally favorable, the days being clear and warm with more than an average amount of sunshine. The nights, however, were quite cool, bringing the daily average temperature down about four degrees below the normal for this period which is usually the hottest portion of the year. To give corn the vigorous growth that is now needed to perfect the crop, the daily mean temperature of this month should not be less than 74°, and August should give an average of 72°.

This crop has made fair progress during the week, where it has been possible to give it necessary cultivation; and its average height is about where it should be in ordinary seasons the 1st to the 4th of July.

Very satisfactory progress has been made in securing the unusually heavy hay crop, and the harvest of winter grain is generally completed in the southern and central districts.

The rainfall of the week was generally very light, but ample for the necessities of the growing crops. The heaviest amount reported was at the central station on Sunday, where the measurement was 1.60 inches.

BULLETIN NO. 15. JULY 19.

The past week brought the most favorable weather of the season for hay-making, and for the rapid growth of the belated crops. The days were generally bright and warm; the cool nights, however, reduced the daily average temperature about three degrees below the normal. The rainfall was generally sufficient for the needs of all crops. On the night of the 14th a severe wind squall, with considerable rain and light streaks of hail, swept diagonally from northwest to southeast through the central counties. Corn and oats were considerably flattened, and some damage was done to light buildings. The crops, however, have mostly straightened up and the damage will be light.

Corn has made rapid growth during the week, and the crop is generally clean. Rust in oats is the burden of complaint in many localities. Potatoes are doing well. Haying is well advanced toward completion.

As one reporter puts it, "Farmers have no time for murmuring and not much reason for it."

BULLETIN NO. 16. JULY 26.

This has been by far the hottest week of the season, and most favorable for the rapid growth of corn. The mean temperature for the State was about 80°, or nearly 6° above the normal. The change is especially notable from the fact that the score of every preceding week has ranged from 2° to 9° below a seasonable average. The air has contained a very high per cent of humidity, making the heat much more oppressive to man and beast. In many localities frequent showers have damaged hay, or seriously interfered with hay making.

It has been an ideal week for corn, which has made a marvelous growth. In the most advanced fields it is fully tasseled and gives promise of a fair

yield. In fully one-third of the State, comprising the larger part of the eastern districts, it will not be possible to produce more than half an average crop. In even the most favored districts there are many fields wherein the stand is poor, and the yield must fall much below the average.

The harvesting of oats will be in progress the coming week. The crop is very uneven, and in many localities considerable damage has been caused by rust. The crop has also suffered some loss by the severe wind storms of the past week, which flattened the heavier growth of straw. Barley cutting has begun, and with favoring weather a fair crop will be secured.

BULLETIN NO. 17. AUGUST 2.

The first two days of the past week were excessively hot, followed by copious and well distributed showers which were generally beneficial to growing crops, but somewhat damaging to hay, barley, and fully ripened oats. The average temperature of the week was slightly below, and the rainfall above the normal, with an average amount of sunshine.

Corn has made good progress, and the present outlook favors the maturing of about two-thirds of an average crop for the State.

Oats have been greatly injured by the conditions which favored corn, the excessive heat causing rust and blight to an unusual extent. It will not be possible to secure more than 60 per cent of the average yield. The harvest of this crop is progressing rapidly, and will be practically completed in the southern and central districts the coming week.

Barley has been discolored to some extent, and the harvest is about completed.

Potatoes, buckwheat, millet and pasturage have been greatly improved.

BULLETIN NO. 18. AUGUST 9.

This has been the hottest and driest week of the season, the daily average temperature being about 8° above normal, and the rainfall very light, with more than the usual amount of sunshine.

In portions of the Missouri valley droughty conditions are reported, and showers are needed to save the growing crops from threatened damage.

Corn has made great progress, and is generally doing well; no appreciable damage being apparent as yet from the excessive heat.

The harvest of small grain is completed in the southern districts and well advanced in all parts of the State. All reports, with rare exceptions, indicate a very light yield of oats, confirming previous estimate of 60 per cent.

The largest crop of hay ever raised in Iowa is now secured, and is generally in good condition. With timely rains and seasonable temperature for the next six weeks, the more advanced of the remaining crops will reach maturity.

BULLETIN NO. 19. AUGUST 16.

The weather of the past week, with temperature and sunshine slightly above normal, has been all that the most exacting farmer could desire in rapidly pushing the corn and bringing it up to its usual advancement for the season. With late frosts the corn crop seems to be assured, but the total will fall materially below the average.

The rainfall has been somewhat local in its character, and yet enough has fallen for all growing crops, except in Decatur and Wayne counties, where

pasture and corn are needing rain. Some damage to small grain reported from the northwest corner of the State by hail and wind.

Harvesting nearly complete in northern part of the State and threshing begun.

Oats are of very light weight and are yielding from twelve to thirty bushels per acre. Wheat and barley are making a better showing, although hardly up to the average.

The ground is in splendid condition for fall plowing, and it seems to be the general opinion of the farmers that this will be taken advantage of and a large acreage of fall grain sown.

BULLETIN NO. 20. AUGUST 28.

The weather during the past week has been exceedingly favorable for stacking and threshing grain, but the deficiency in rainfall and the cool nights during the latter part of the week, has checked the heretofore rapid growth of corn, although this crop is reported as having made material advancement, and with occasional light showers and a continuation of warm sunshiny weather until September 20th the crop will be assured, although the total yield will fall considerably below the average of previous years.

Stacking of small grain is about completed and threshing well advanced, showing a good yield of wheat, rye and barley.

Oats will not come up to the average, as reports show this crop to be light in quantity and quality.

Rain is needed for potatoes, pastures and fall plowing.

BULLETIN NO. 21. AUGUST 30.

The temperature of the past week was very nearly up to the seasonable average, and the rainfall was abundant and well distributed. The conditions were generally favorable for the rapid growth of unharvested crops.

Corn has made good progress, and three weeks of favorable weather will place the more advanced fields beyond danger. To ripen the entire crop, however, the coming month must be warm, generally dry and free from killing frosts.

All reports of threshing confirm previous estimates as to shortage of the crop of oats; the total yield cannot exceed 60 per cent of an average, and the quality is below grade.

Fall plowing is progressing rapidly, and a greatly increased acreage of winter wheat will be planted.

BULLETIN NO. 22. SEPTEMBER 6.

The past week has been unseasonably cool and dry, the daily average temperature being about 3° below normal, and the rainfall generally deficient. Light frosts occurred on three mornings in various localities in the northern half of the State, but no material damage resulted.

The ripening of corn has been retarded, but it is doing fairly well. Answering a special inquiry, the majority of observers of this Bureau report that with favorable weather the greater part of the corn crop will be safe from frost about the 20th to 25th of September. It is quite certain, however, that if a killing frost occurs before October 1st there will be much more than the usual amount of soft corn in the State.

Rain is needed in the larger part of the State to facilitate plowing, and for pasturage and potatoes.

BULLETIN NO. 23. SEPTEMBER 13.

The past week was unseasonably cool, the daily average temperature being 2° or 3° below normal, and the sunshine less than the average amount. The rainfall was generally copious, and in the eastern and north-eastern districts it was very heavy, causing some damage to crops.

Corn has made slow progress toward maturity, but is doing fairly well and the bulk of it will be safe by the 25th if there is no frost. The soil is now in excellent condition and a very greatly increased acreage of winter wheat is being planted. Pastures and late potatoes have been much improved.

This morning's weather report shows a cold wave in the northwest, and indicates a damaging frost in northern part of the State on Wednesday morning.

BULLETIN NO. 24. SEPTEMBER 19.

The past week was cool and dry with more than the average amount of sunshine. The daily mean temperature was about 3° below normal, and light frosts occurred on the 14th and 16th causing some damage to late crops in low places.

Corn has made fair progress under adverse conditions as to temperature

On the first of September corn was as far advanced as the crop of last season on corresponding date. But during the present month the daily average temperature has been 4½° lower than in the corresponding period last year. From this comparative statement the present status of this crop may be inferred.

Conditions are variable. In some localities a considerable portion is mature and cutting is in progress. But in all districts more than half the crop needs eight to ten days ripening weather to place it beyond danger.

The frosts of last week have not materially reduced the prospective output of sound corn.

BULLETIN NO. 25. SEPTEMBER 27.

The past week has been abnormally hot and dry, with more than the average amount of sunshine. The daily temperature averaged 11° above the normal and the rainfall was generally very light.

High winds prevailed nearly every day, which, with the high temperature, bright sunshine, and low percentage of humidity, hastened the ripening of belated corn and carried the bulk of the crop beyond the danger line. It is now practically assured, though there will be somewhat more than the usual amount of soft and shrunken corn.

The area of corn planted in Iowa this year was nearly 6,500,000 acres, and this was materially reduced by heavy rains, causing imperfect cultivation or total abandonment of many fields. On the basis of reports received from all parts of the State this Bureau estimates a total yield of not more than 175,000,000 bushels, which is nearly two-thirds of an average crop, or one-half the amount credited to the State last year by the government report. This estimate is, of course, subject to revision by final returns of the season, December 1st.

Rain is greatly needed for pasturage, for the germination of fall wheat, and to facilitate plowing.



## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
ALTA, BUENA VISTA COUNTY.

BY D. E. HADDEN, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction
	Mean.	Maximum.	Minimum.			
January .....	18.2	46	-28	3.34	3.5	NW
February .....	22.8	43	-13	1.14	6.0	SE
March .....	29.3	57	1	2.74	2.5	NW
April .....	42.3	80	20	4.54	11.0	SE
May .....	48.8	74	31	10.39	7	NW
June .....	66.4	95	44	2.15	0	NW
July .....	71.7	95	49	2.76	0	SE
August .....	69.5	94	42	4.63	0	SE
September .....	64.4	89	34	0.70	0	S
October .....	53.7	88	19	1.16	0	NW
November .....	30.8	65	4	0.21	.2	NW
December .....	16.6	52	-20	0.64	5.2	NW
Sums .....				32.20	28.4	
Averages .....	44.1	95	-28			
RECAPITULATION BY SEASONS—						
Winter months .....	17.5	52	-28	2.12	14.7	NW
Spring months .....	40.1	80	1	17.67	13.5	NW
Summer months .....	69.2	95	42	10.34	0	SE
Autumn months .....	49.6	89	4	2.07	0.2	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
ALGONA,\* KOSSUTH COUNTY.

BY JAS. BARR, M. D., VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	22.5	40	-10	1.84	6.0	
February .....	29.2	60	0	1.08	4.2	
March .....	41.8	64	22	3.82	1.8	
April .....	51.3	76	33	5.29	0.1	
May .....	65.7	94	49	4.64	0	
June .....	73.1	92	56	3.44	0	
July .....	70.0	92	47	2.71	0	
August .....	63.8	86	46	.35	0	
September .....	52.2	88	21	1.41	0	
October .....	30.2	60	8	0.20	0	
November .....	15.3	70	-20	3.00	5.0	
December .....						
Sums .....						
Averages .....		94				
RECAPITULATION BY SEASONS—						
Winter months .....	40.8	76	0	10.19	6.1	
Spring months .....	69.6	94	47	10.79		
Summer months .....	48.7	86	8	1.96		
Autumn months .....						

\*Maximum and minimum taken from eye readings.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
AMANA, IOWA COUNTY.

BY CONRAD SCHÄDT, VOLUNTARY OBSERVER.

February	29.3	88	- 4	1.29	2.8	NW
March	32.3	68	8	2.64	1.0	NW
April	45.8	72	22	4.48		NE
May	53.1	76	34	7.38		NW
June	69.1	93	50	9.67		S
July	73.1	93	46	5.34		SW
August	70.9	92	43	2.99		S
September	63.2	87	29	1.88		S
October	52.8	84	22	1.15		S
November	31.9	54	5	1.37	4.5	S
December	17.0	45	-17	1.90	9.5	NW
Sums				42.43	24.6	
Averages	46.2	93	-21			NWS
RECAPITULATION BY SEASONS—						
Winter months	20.2	58	-21	5.58	12.1	NW
Spring months	44.4	76	8	14.45	1.0	NW
Summer months	71.0	93	34	18.00	0	S
Autumn months	49.3	92	5	4.40	4.5	S

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
AMES, STORY COUNTY.

BY F. C. STEWART, VOLUNTARY OBSERVER.



ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
ATLANTIC, CASS COUNTY.

BY J. W. LOVE, VOLUNTARY OBSERVER.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
BANCROFT, KOSSUTH COUNTY.

BY H. N. RENFREW, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall	Prevailing wind direction
	Mean.	Maximum.	Minimum.			
January .....	11.0	45	-32	1.10	1.0	NW
February .....	22.7	42	-20	1.00	1.0	NW
March .....	29.9	57	0	1.54	...	NW
April .....	42.1	64	19	4.32	10.0	SE
May .....	50.8	72	32	6.47	...	...
June .....	65.1	92	42	3.67	...	...
July .....	71.8	92	46	3.48	...	...
August .....	68.4	91	43	2.85	...	...
September .....	63.4	88	36	2.44	...	...
October .....	51.9	69	11	.00	...	...
November .....	...	...	...	...	...	...
December .....	...	...	...	...	...	...
Sums .....	...	...	...	...	...	...
Averages .....	...	92	-32	...	...	...
RECAPITULATION BY SEASONS—						
Winter months ..	...	...	...	...	...	...
Spring months ..	40.9	72	0	12.83	10.0	...
Summer months ..	68.8	92	40	14.00	...	...
Autumn months ..	...	...	...	...	...	...

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
BELLE PLAINE, BENTON COUNTY.

BY H. W. VANDIKE, VOLUNTARY OBSERVER.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
BLAKEVILLE, BLACKHAWK COUNTY.

BY JAMES RODGERS, VOLUNTARY OBSERVER.

				snow--inches.	Total snowfall.	Prevailing wind direction.
				1.02	10.2	
				1.15	8.6	
				1.18	8.0	
				2.43	5.0	
				1.97		
				1.30		
				1.75		
				2.80		
				1.48	2.0	
				2.41	18.0	
Suma..					49.7	
Averages.....			-26			
RECAPITULATION BY SEASONS--						
Winter months.....	19.8	55	-26	4.58	35.2	
Spring months.....	44.4	81	1	12.58	11.0	
Summer months.....	72.3			15.85	0	
Autumn months.....					2.0	

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT BLOCKTON, TAYLOR COUNTY.

BY C W THOMPSON, VOLUNTARY OBSERVER

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
January.....	1.5	55	-30	1.5	3.0	..
February.....	81.3	65	3	1.48	3.0	..
March.....	33.8	75	6	3.37	0	..
April.....	47.5	74	24	8.88	0	..
May.....	56.6	79	35	11.21	0	NW
June.....	70.8	94	49	3.06	..	..
July.....	74.8	96	44	3.14	..	..
August.....	70.9	98	43	2.04	..	..
September.....	65.0	92	35	2.29	..	..
October.....	59.1	85	21	2.10	..	..
November.....	35.2	63	10	.41	..	..
December.....	20.4	55	-13	.60	8.0	..
Sums.....				86.85	22.0	..
Averages.....	48.1	90	-30			..
RECAPITULATION BY SEASONS—						
Winter months.....	28.2		-10	2.68	17.0	..
Spring months.....	46.0	79	6	16.44	5.5	..
Summer months.....	72.2	98	44	10.24	0	..
Autumn months.....	51.4	92	10	4.70	0	..

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT BONAPARTE, VAN BUREN COUNTY.

BY HON. B. R. VALE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction
January.....	19.4	62	-15	5.5	8.0	..
February.....	33.0	66	-10	5.6	0	..
March.....	39.4	68	-7	2.7	..	..
April.....	49.7	74	0	0	..	..
May.....					..	..
June.....	75.9	90	..	2.3	..	..
July.....	74.1	90	..	7.9	..	..
August.....					..	..
September.....	66.3	91	..	2.0	..	..
October.....	56.4	83	..	7.6	..	..
November.....	39.2	63	..	7.1	6.0	..
December.....	24.8	54	..	8.9	..	..
Sums.....						..
Averages.....			-18			..
RECAPITULATION BY SEASONS—						
Winter months.....	25.7	66	-18	5.20	..	..
Spring months.....					..	..
Summer months.....					..	..
Autumn months.....	63.0	91	13	6.87	..	..

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
CARROLL, CARROLL COUNTY.

BY MOSES SIMON, VOLUNTARY OBSERVER.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
CEDAR FALLS, BLACK HAWK COUNTY.

BY PROF. A. C. PAGE, VOLUNTARY OBSERVER.

MONTH	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	11.9	51	-32	.47	..	NW
February.....	..	..	-10	.73	3.6	NW
March.....	31.3	60	2	1.34	..	NW
April.....	44.2	71	14	3.82	6.0	SE
May.....	52.5	66	32	11.00	..	NE
June.....	..	87	62	4.89	..	SE
July.....	72.0	94	43	6.67	..	SE
August.....	71.5	90	48	2.21	..	SE
September..	63.8	93	48	2.21	..	SE
October.....	52.2	86	21	2.06	..	NW
November..	30.8	54	4	1.01	..	NW
December..	16.2	51	-17	1.00	12.0	NW
Suma.....	..	..	..	36.41	..	..
Averages.....	..	94	-32	..	..	NW
RECAPITULATION BY SEASONS—	..	..	..	..	..	..
Winter months.....	..	..	-32	2.20	..	NW
Spring months.....	43.7	71	2	16.16	..	SE NE
Summer months.....	..	94	43	12.77	..	SE
Autumn months.....	46.9	92	4	5.28	..	SE NW

ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
CEDAR RAPIDS, LINN COUNTY.

BY H. D. OLDS, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	19.2	50	-20	2.82	8.2	W
February.....	30.3	51	- 3	2.18	8.7	EE
March.....	32.5	60	5	2.38	3.6	EE
April.....	46.6	74	24	4.15	1.0	EE
May.....	55.3	78	33	10.12	.....	EE
June.....	71.8	94	46	7.48	.....	SE
July.....	73.7	96	52	4.45	.....	SE
August.....	75.4	95	48	2.07	.....	SE
September.....	67.4	90	45	2.33	.....	SE
October.....	55.6	85	27	1.03	.....	SE
November.....	33.6	53	8	1.60	5.7	NW
December.....	19.7	44	-12	2.02	5.7	NW
Sums.....	.....	.....	.....	42.63	33.9	.....
Averages.....	48.0	96	-20	.....	.....	E
RECAPITULATION BY SEASONS—						
Winter months.....	21.7	51	-20	7.02	23.6	NW
Spring months.....	44.8	76	5	16.65	5.6	E
Summer months.....	73.5	96	46	14.00	0	SE
Autumn months.....	52.2	90	8	4.96	5.7	SE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CHARLES CITY, FLOYD COUNTY.

BY J. W. SMITH, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	11.6	48	-26	1.90	9.6	W
February.....	23.0	44	-12	.75	4.0	.....
March.....	29.0	62	- 1	1.47	4.2	.....
April.....	41.5	61	18	3.10	5.0	.....
May.....	51.0	70	34	5.38	.....	.....
June.....	65.0	88	44	8.12	.....	.....
July.....	76.9	92	48	2.77	.....	.....
August.....	68.7	92	42	1.59	.....	.....
September.....	62.8	86	33	1.48	.....	.....
October.....	51.4	84	18	1.27	.....	.....
November.....	29.0	48	- 3	1.42	1.5	.....
December.....	16.1	42	-20	1.25	11.5	.....
Sums.....	.....	.....	.....	30.08	31.2	.....
Averages.....	43.8	92	-26	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	16.9	48	-26	3.50	20.5	.....
Spring months.....	40.5	70	- 1	9.93	9.2	.....
Summer months.....	70.2	92	42	12.48	.....	.....
Autumn months.....	47.7	86	- 3	4.17	1.5	.....

ANNUAL SUMMARY ON METEOROLOGICAL OBSERVATIONS AT  
CENTERVILLE, APPANOOSE COUNTY.

BY I. J. ONG, VOLUNTARY OBSERVER.

MONTH	TEMPERATURE			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction
	Mean	Maximum	Minimum			
January.....						
February.....						
March.....						
April.....						
May.....						
June.....	70.0	85	42	4.48		
July.....	71.3	96	88	11.69		
August.....	69.3			1.06		
September.....	68.1	91	88	1.07		
October.....	62.1			1.20		
November.....	53.4			1.21	T	
December.....	20.2	54	-22	2.12		
Sums.....						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....						
Spring months.....						
Summer months.....	70.2			18.12		
Autumn months.....	49.5			8.46		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CLARINDA, PAGE COUNTY.

BY A. S. VAN SANDT, VOLUNTARY OBSERVER.

January.....	18.5	57	-20	.44	0.0	N
February.....	30.5	52	4	1.19	4.5	NW
March.....	34.6	73	7	2.04	2.5	N
April.....	49.0	76	27	5.14	0.2	ENE
May.....	56.3	79	30	11.55	T	NW
June.....	72.5	94	49	7.25		SS
July.....	76.9	100	64	4.87		SS
August.....	74.2	97	61	2.85		SS
September.....	68.8	93	42	.63		SS
October.....	57.2	87	20	1.06		SS
November.....	37.4	67	16	.29	T	SS
December.....	20.6	54	-15	2.16	20.0	N
Sums.....					.2	
Averages.....	49.7	100	-20			
RECAPITULATION BY SEASONS—						
Winter months.....	33.8	57	-20		.5	N
Spring months.....	45.8	73	7		.7	ENE
Summer months.....	74.5	94	49			SS
Autumn months.....	54.5	87	16			SS

## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CLINTON, CLINTON COUNTY.

BY DR. LUKE ROBERTS, VOLUNTARY OBSERVER.

	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
January.....	10.9	46	-10	1.31	3.0	SW
February.....	29.9	62	-1	1.76	0.2	NW
March.....	32.7	62	5	1.81	4.0	NE
April.....	46.7	77	23	4.43	.....	NE
May.....	55.6	78	34	8.41	.....	NE
June.....	68.5	94	51	9.39	.....	NE
July.....	73.2	96	47	4.49	.....	NE
August.....	73.7	96	45	1.81	.....	SE
September.....	63.5	85	40	1.20	.....	S
October.....	53.5	88	20	.63	.....	S
November.....	32.1	57	4	2.58	3.0	NW
December.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	96	.....	.....	.....	NE
RECAPITULATION BY SEASONS—						
Winter months.....	.....	.....	.....	.....	.....	.....
Spring months.....	45.0	79	5	14.65	4.0	NE
Summer months.....	73.4	96	45	15.69	0	NE
Autumn months.....	49.8	89	4	4.41	3.0	S

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
COLLEGE SPRINGS, PAGE COUNTY.

BY A. A. BERRY, VOLUNTARY OBSERVER.

	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
January.....	33.3	60	6	.86	5.0	.....
February.....	44.5	68	9	3.09	3.0	.....
March.....	44.5	68	23	8.38	.....	.....
April.....	47.7	78	20	8.64	.....	.....
May.....	59.7	94	44	2.16	.....	.....
June.....	74.4	97	62	3.37	.....	.....
July.....	74.8	99	47	2.95	.....	.....
August.....	68.8	92	30	1.24	.....	.....
September.....	60.5	92	28	2.43	.....	.....
October.....	39.0	69	12	.44	.....	.....
November.....	21.5	62	-18	3.04	23.5	.....
December.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	90	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	.....	.....	.....	.....	.....	.....
Spring months.....	42.4	78	9	20.11	3.0	.....
Summer months.....	73.0	90	44	8.48	.....	.....
Autumn months.....	56.1	92	19	4.11	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CORNING, ADAMS COUNTY.

BY J. W. BIXBY, VOLUNTARY OBSERVER.

Month	Mean	Maximum	Minimum	Total precipitation rain and melted snow—Inches.	Total snowfall	Prevailing wind direction
January	30.0	54	-41	1.06	4.2	
February	34.5	74	5	.06	4.5	
March	47.0	78	34	2.11		NW
April	55.0	78	35	3.85		NW
May	68.5	93	48	1.90		SW
June	73.3	94	50	5.47		SE
July	71.5	95	48	1.65		NE
August	66.2	91	37	2.66		SW
September	54.8	84	23	1.74		
October	35.7	65	10	.33	T	SE
November	19.0	55	-18	1.73	14.0	SW
December						
<b>Sums</b>				<b>35.68</b>	<b>27.2</b>	
<b>Averages</b>	<b>47.9</b>	<b>95</b>	<b>-41</b>			
<b>RECAPITULATION BY SEASONS—</b>						
Winter months	23.2	50	-31	8.76	22.7	
Spring months	45.7	76	5	17.56	4.5	
Summer months	71.5	95	47	9.41	0	SE NE
Autumn months	62.2	91	10	4.93		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CRESCO, HOWARD COUNTY.

BY GREGORY MARSHALL, VOLUNTARY OBSERVER.

Month	TEMPERATURE			Total precipitation rain and melted snow—Inches.	Total snowfall	Prevailing wind direction
	Mean.	Maximum.	Minimum.			
January					5	NW
February					0	NW
March					0	NE
April					0	NW
May					0	NW
June					0	NE
July					0	SE
August					0	NE
September					0	NW
October					0	NW
November					0	SE
December					0	NW
<b>Sums</b>					<b>5</b>	
<b>Averages</b>						<b>NW</b>
<b>RECAPITULATION BY SEASONS—</b>						
Winter months					0	NW
Spring months					0	NW
Summer months					0	NE
Autumn months					0	NW



# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT DAVENPORT, SCOTT COUNTY.

BY F. J. WALZ, OBSERVER UNITED STATES WEATHER BUREAU.

## ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT DELAWARE,\* DELAWARE COUNTY.

BY WM. BALL, VOLUNTARY OBSERVER.

Sums.....	.....	.....	.....	41.00	29.5	.....
Averages.....	43.0	94	-23	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	16.1	.....	-23	4.74	16.4	.....
Spring months.....	40.8	.....	3	12.01	7.5	NE
Summer months.....	69.1	94	42	17.59	0	S
Autumn months.....	45.8	.....	.....	6.66	5.6	NW

\*Maximum and minimum taken from eye readings.

**ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DES MOINES, POLK COUNTY.**

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**BY GEO. M. CHAPPEL, LOCAL FORECAST OFFICIAL, U. S. WEATHER BUREAU.**

**ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DUBUQUE, DUBUQUE COUNTY.**

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**BY S. C. EMERY, OBSERVER UNITED STATES WEATHER BUREAU.**

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
EAGLE GROVE,\* WRIGHT COUNTY.

BY C. A. SCHAFER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	8.5		-35			
February.....						
March .....	27.6	58	0	2.25	2.5	
April.....						
May.....	51.6		30	10.30		
June.....	68.8			2.85		
July.....	73.2			9.25		
August .....	70.0	90	42	2.20		
September.....	62.3		38	.35		
October.....	49.6			2.10		
November.....	28.6	56	5	.30		
December.....	13.0		-20	1.80		
Sums.....			-35			
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months .....						
Spring months.....						
Summer months.....	70.5					
Autumn months.....	46.8					

\*Maximum and minimum taken from eye readings.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
FAIRFIELD, JEFFERSON COUNTY.

BY J. FRED CLARKE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January ..	18.0	33	-20	9.15	12.0	
February.....						
March .....	33.0	66	5	2.74	5.7	
April.....				7.04	.5	
May.....				12.01		
June.....	60.7	90	50	4.27		
July ...	74.4	92	46	6.41		
August.....	71.9	94	48	1.94		
September.....	65.2	91	40	.83		
October.....	56.1	84	27	1.60		
November....				1.36	5.2	
December.....						
Sums.....						
Averages.....						
Winter months .....						
Spring months.....				21.79	6.2	
Summer months.....	72.0	94	46	12.62		
Autumn months ..				8.79		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
FAYETTE, FAYETTE COUNTY.

BY R. Z. LATIMER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	13.1	48	-26	96	.....	NW
February.....	26.3	58	-10	1.02	.....	NW
March.....	30.7	56	2	2.71	.....	NE
April.....	41.4	69	18	6.57	.....	SE
May.....	52.3	76	30	6.66	.....	SE
June.....	66.3	90	45	11.63	.....	SE
July.....	72.0	95	49	2.36	.....	SE
August.....	70.2	94	40	2.30	.....	SE
September.....	62.7	90	33	2.08	.....	SW
October.....	51.9	84	21	3.25	.....	SE
November.....	30.5	50	1	.87	.....	NW
December.....	17.3	47	-21	1.18	.....	NW
Sums.....	.....	.....	.....	40.56	.....	.....
Averages.....	44.6	66	-26	.....	.....	SE
RECAPITULATION BY SEASONS—						
Winter months.....	18.9	58	-26	1.11	.....	NW
Spring months.....	41.5	76	2	14.94	.....	SE
Summer months.....	66.5	95	40	15.28	.....	SE
Autumn months.....	48.4	90	1	1.13	.....	SW SE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
FORT MADISON,\* LEE COUNTY.

BY L. A. M'CREADY, VOLUNTARY OBSERVER.

\*Maximum and minimum taken from eye reading.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GLENWOOD, MILLS COUNTY.

BY SETH DEAN, VOLUNTARY OBSERVER.

Ja. Fe. Ma. Ap. Ma. Ju. Ju. Au. Se. Oc. No. De.						Prevaling wind direction.
	Mean.	Maximum.	Minimum.	Total precipitation rain and melted snow—inches.	Total snowfall.	
Averages.....	51.6	104	-33	.....	.....	S
RECAPITULATION BY SEASONS—						
Winter months.....	25.8	76	-33	3.84	.....	NW
Spring months.....	47.7	88	-6	15.78	8.2	SE
Summer months.....	75.9	104	48	7.65	0	SE
Autumn months.....	56.1	86	11	1.79	.....	S

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GRAND MEADOW,\* CLAYTON COUNTY.

BY F. L. WILLIAMS, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevaling wind direction.
	Mean.	Maximum.	Minimum.			
January.....	25.2	47	-12	1.01	4.5	.....
February.....	28.4	56	0	2.17	7.8	.....
March.....	48.0	70	20	5.18	4.8	.....
April.....	52.5	77	34	8.83	.....	.....
May.....	64.2	91	48	11.91	.....	.....
June.....	70.0	91	52	4.73	.....	.....
July.....	68.1	90	45	4.11	.....	.....
August.....	61.8	83	44	1.26	.....	.....
September.....	51.2	76	28	2.56	.....	.....
October.....	30.8	48	8	1.21	1.1	.....
November.....	17.1	44	-13	1.05	8.0	.....
December.....	.....	.....	.....	45.00	32.0	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	44.0	91	-22	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	18.0	47	-22	4.31	19.3	.....
Spring months.....	42.0	77	0	15.68	12.6	.....
Summer months.....	67.4	91	45	20.75	0	.....
Autumn months.....	47.8	83	8	5.05	1.1	.....

\*Maximum and minimum taken from eye reading.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GREENFIELD, ADAIR COUNTY.

BY J. G. CULVER, VOLUNTARY OBSERVER.

Averages .....	46.0	95	-27	...	...	S
RECAPITULATION BY SEASONS—						
Winter months .....	21.0	58	-27	4.09	26.9	SW
Spring months .....	43.5	79	4	16.49	9.3	S SW NW
Summer months .....	70.5	95	44	10.95	0	S
Autumn months .....	49.0	93	5	2.80	T	■

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GRINNELL, POWESHIEK COUNTY.

BY PROF. S. J. BUCK, VOLUNTARY OBSERVER.

## MONTH.

January .....	16.9	44	-24	1.04	...	N
February .....	28.4	49	-5	1.32	...	SE
March .....	32.2	65	3	2.60	...	N
April .....	46.1	68	23	2.96	...	SE
May .....	51.9	73	33	6.88	...	E
June .....	62.0	88	49	2.79	...	...
July .....	74.0	92	55	4.44	...	S
August .....	72.8	91	51	2.15	...	S
September .....	64.2	86	43	1.98	...	S
October .....	54.2	85	5	1.50	...	NW
November .....	32.2	56	5	1.09	...	N
December .....	18.2	49	-17	1.81	14.6	S
Sums .....				32.56	...	...
Averages .....	45.3	92	-24	...	...	S
RECAPITULATION BY SEASONS—						
Winter months .....	47.0	49	-24	4.17	...	N SE
Spring months .....	44.4	73	3	14.26	...	N SE E
Summer months .....	71.9	92	49	9.38	...	...
Autumn months .....	38.9	66	5	4.45	...	S

## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GRUNDY CENTER, GRUNDY COUNTY.

BY CHAS. ROGERS, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	11.5	48	-24	4.4	4.5	.....
February.....	1	48	-8	1.68	0.0	.....
March.....	8	56	3	1.68	.....	.....
April.....	8	68	24	4.50	10.5	.....
May.....	8	72	36	9.30	.....	.....
June.....	7	91	50	5.22	.....	.....
July.....	2	99	50	8.51	.....	.....
August.....	5	93	42	1.64	.....	.....
September.....	1	80	38	.....	.....	.....
October.....	9	88	24	2.34	.....	.....
November.....	0	52	5	48	.....	NW
December.....	7	50	-19	1.87	17.0	.....
Sums.....	.....	.....	.....	82.94	45.5	.....
Averages.....	44.9	90	-24	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	18.4	50	-24	3.19	27.5	.....
Spring months.....	43.1	72	8	15.57	18.0	.....
Summer months.....	69.9	90	42	10.47	0	.....
Autumn months.....	48.3	90	5	.....	0	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
HAMPTON, FRANKLIN COUNTY.

BY E. C. GRENELLE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	12.3	47	-27	4.3	3.0	NW
February.....	23.0	45	-14	1.13	5.9	NW
March.....	28.6	57	0	1.63	2.2	NW
April.....	42.1	67	20	8.63	14.0	SE
May.....	50.6	72	32	11.12	.....	NW
June.....	65.6	90	44	4.32	.....	NW
July.....	69.9	93	45	5.64	.....	SE
August.....	68.4	90	43	1.07	.....	SE
September.....	63.8	90	30	.....	.....	SW
October.....	61.0	80	21	2.01	.....	NW
November.....	24.2	53	8	1.03	0.8	NW
December.....	14.9	50	-10	1.43	14.0	NW
Sums.....	.....	.....	.....	34.05	.....	.....
Averages.....	43.3	93	-27	.....	.....	NW
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	16.7	50	-27	2.98	22.8	NW
Spring months.....	40.5	72	0	16.08	17.2	NW
Summer months.....	68.0	93	44	11.07	0	SE
Autumn months.....	47.8	90	31	3.93	0.8	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS. AT  
HAWKEYE, FAYETTE COUNTY.

BY J. W. BOPP, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction
	Mean.	Maximum.	Minimum.			
January.....				1	0	
February.....				1	0	
March.....				1	0	
April.....				5	0	
May.....				5	0	
June.....				3	0	
July.....				3	0	
August.....				3	0	
September.....				1	0	
October.....				1	0	
November.....				1	0	
December.....				2	0	
Sums.....				35	0	
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months...				4.12	22.5	
Spring months...				10.63	6.0	
Summer months...				15.62	0	
Autumn months...				5.23	2.0	

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS. AT  
HOPEVILLE, CLARKE COUNTY.

BY M. T. ASHLEY, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction
	Mean.	Maximum.	Minimum.			
January.....	12.7	55	-28	1.61	6.0	NW
February.....		53	0	1.46	2.6	NW
March.....		72	6	2.15		NW
April.....		71	24	4.68		NW
May.....		75	38	10.84		NW
June.....		91	47	2.50		
July.....		78	45	7.40		SE
August.....		83	46	.91		SE
September...		70	38	1.86		
October.....		56	23	2.61		S
November.....		42	8	.66	T	NW
December.....		52	-18	1.10		NW
Sums.....				38.13		
Averages.....	47.4	93	-23			NW
RECAPITULATION BY SEASONS—						
Winter months...	21.8	55	-28	4.23		NW
Spring months...	44.9	75	6	17.67		NW
Summer months...	70.9	93	46	11.07		SE
Autumn months...	52.1	90	8	5.13		S



## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
HOPKINTON, DELAWARE COUNTY.

BY T. MARKS, VOLUNTARY OBSERVER.

				TEMPERATURE.	Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
				18	1.74	12.0	NW
				5	1.54	5.0	SE
				8	1.50	5.0	NE
				12	4.26	4.0	SE
				16	7.11	.....	SE
				18	10.13	.....	SE
				18	5.29	.....	SE
				18	2.49	.....	SE
				19	5.55	.....	SE
				20	7.50	.....	SE
				6	2.05	10.0	W
				11	2.25	11.0	NW
Sums.....					45.41	47.0	.....
Averages.....				47.3	93	-18	SE
RECAPITULATION BY SEASONS—							
Winter months.....				22.1	49	-18	NW
Spring months.....				45.4	75	-8	SE
Summer months.....				70.8	92	48	SE
Autumn months.....				51.3	84	6	SE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
INDEPENDENCE, BUCHANAN COUNTY.

BY E. F. WULFKE, VOLUNTARY OBSERVER.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
INDIANOLA, WARREN COUNTY.

BY J. L. TILTON, VOLUNTARY OBSERVER.

Month	Mean	Maximum	Minimum	Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
January	30.6	53	-2	1.34	5.0	NW
February	34.7	67	6	1.31	3.8	NW
March	48.7	70	34	3.95	1.0	SW
April	55.6	77	34	10.47		NW
May	68.9	91	49	4.12		NW
June	73.4	103	50	2.50		SW
July	69.3	94	46	1.02		NW
August	65.3	93	30	1.43		NW
September	55.0	87	24	2.34		SW
October	55.1		6	.79		NW
November	16.3	50	-20	1.29	12.8	SW
December						
Sums..				32.58	28.6	
Averages	47.8	94	-26			NW
RECAPITULATION BY SEASONS—						
Winter months	31.8		-26	3.74		
Spring months	46.3	77	6	15.74		NW
Summer months	70.5	94	46	8.54		NW
Autumn months	52.5		6	4.56		NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
IOWA CITY, JOHNSON COUNTY.

BY PROF. A. L. ARNER, VOLUNTARY OBSERVER.

Month	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January	17.3	41	-23	1.46	11.8	NW
February			3	1.23	T	SE
March			4	3.15	1.0	NW
April			22	4.30	1.2	NW
May			34	9.23		NW
June			50	8.29		NW
July			44	5.20		SE
August			44	2.50		SE
September			38	1.18		S
October			21	1.02		NW
November			4	1.38	0.0	NW
December			16	2.64	9.0	NW
Sums..				42.76	32.0	
Averages	47.3	96	-22			NW
RECAPITULATION BY SEASONS—						
Winter months	31.8	56	-22	5.53	20.8	NW
Spring months	46.4	77	-4	5.68	2.2	NW
Summer months	71.3	96	44	18.90	0	NW SE S
Autumn months	50.7	92	4	3.56	9.0	NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT KEOKUK, LEE COUNTY.

BY FRED. GOSEWISCH, OBSERVER UNITED STATES WEATHER BUREAU.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	19.6	55	-16	1.96	...	NW
February .....	33.0	57	5	1.81	...	NW
March .....	36.2	72	8	2.91	...	NW
April .....	49.2	75	26	6.15	...	NE
May .....	58.1	77	35	6.34	...	SE
June .....	73.0	92	52	2.65	...	SE
July .....	74.6	94	50	6.16	...	SW
August .....	74.8	95	51	1.07	...	N
September .....	67.2	90	45	3.21	...	S
October .....	67.2	86	29	.71	...	NW
November .....	36.4	62	14	3.15	...	W
December .....	25.9	59	-9	1.50	...	NW
Sums .....				37.45		
Averages .....	50.4	86	-16			NW
RECAPITULATION BY SEASONS—						
Winter months .....	36.2	59	-16	5.07		NW
Spring months .....	47.8	78	8	10.40		NW NE
Summer months .....	74.1	95	50	9.90		SE SW N
Autumn months .....	63.6	90	14	7.08		SE NW W

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT KEOSAUQUA, VAN BUREN COUNTY.

BY PROF. J. H. LANDES, VOLUNTARY OBSERVER.

MONTH	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall	Prevailing wind direction.
	Mean	Maximum	Minimum			
January .....	20.0	54	-18	1.40	2.0	
February .....	32.1	57	4	1.89	7.0	
March .....	36.5	69	8	3.26	4.1	
April .....	49.2	72	26	7.18	7.0	
May .....	58.0	80	37	7.36		
June .....	72.4	95	51	4.32		
July .....	74.6	94	51	5.55		
August .....	74.4	97	57	2.32		
September .....	67.7	91	12	2.33		
October .....	56.5	87	34	.57		
November .....	36.4	67	14	1.82	5.0	
December .....	24.3	55	6	2.07	2.0	
Sums .....				39.57	17.1	
Averages .....	50.3	97	-18			
RECAPITULATION BY SEASONS—						
Winter months .....	36.8	59	-18	5.36	8.0	
Spring months .....	47.9	80	8	17.80	4.1	
Summer months .....	73.9	97	51	12.19		
Autumn months .....	58.5	93	14	4.22	5.0	

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
LARRABEE, CHEROKEE COUNTY.

BY H B STREVER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	11.5	43	-32	1.1	6	...
February.....	21.7	53	14	1.1	6	...
March.....	29.8	64	1	1.1	0	...
April.....	43.7	78	18	3.1	0	...
May.....	51.0	78	30	2.9	...	...
June.....	67.5	94	40	2.3	...	...
July.....	72.8	98	43	4.1	...	...
August.....	69.7	97	42	4.1	...	...
September.....	62.5	88	33	1.1	...	...
October.....	55.2	88	15	1.1	...	...
November.....	36.8	67	2	...	...	...
December.....	17.6	53	19	...	6	NW
Sums.....	.....	.....	.....	32.88	87.7	.....
Averages.....	.....	99	-32	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	16.9	53	-32	2.17	16.7	.....
Spring months.....	41.5	78	1	16.90	21.0	.....
Summer months.....	70.0	98	40	11.46	0	.....
Autumn months.....	49.3	88	2	2.35	T	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
LOGAN, HARRISON COUNTY.

BY MRS. M. B. STERN, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	18.7	66	-29	1.90	9.0	...
February.....	31.6	82	-3	1.14	7.0	NE
March.....	38.2	74	5	4.58	15.0	NE
April.....	49.3	84	24	4.91	0.0	...
May.....	55.8	90	35	7.13	...	NW
June.....	71.2	97	47	3.14	...	SW
July.....	78.3	100	51	4.55	...	...
August.....	73.6	97	47	3.37	...	NE
September.....	67.6	96	36	2.00	...	SW
October.....	57.1	92	22	1.81	...	SW
November.....	37.8	68	10	.08	...	NW
December.....	21.5	62	-15	1.62	12.0	NW
Sums.....	.....	.....	.....	35.25	49.0	.....
Averages.....	49.7	100	-29	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	23.9	63	-29	3.66	28.0	NW
Spring months.....	47.1	84	5	16.62	21.0	...
Summer months.....	73.7	100	47	11.08	...	...
Autumn months.....	54.2	95	10	3.69	...	SW

ANNUAL REPORT OF THE  
ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS. AT  
MAQUOKETA,\* JACKSON COUNTY.

BY DR. A. B. BOWEN, VOLUNTARY OBSERVER.

MONTH	TEMPERATURE			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction
	Mean	Maximum.	Minimum			
January.....	14.0	44	-20	0.6	9.0	.....
February.....	20.1	48	- 4	1.71	.....	.....
March.....	31.9	62	8	2.54	.....	.....
April.....	45.3	72	20	5.93	T	.....
May.....	55.8	78	40	9.33	.....	.....
June.....	68.5	93	50	9.62	.....	.....
July.....	73.4	96	55	6.48	.....	.....
August.....	70.4	94	51	2.27	.....	.....
September.....	61.0	90	42	1.08	.....	.....
October.....	.....	.....	.....	.....	.....	.....
November.....	31.8	52	0	1.78	4.0	.....
December.....	18.9	.....	.....	2.29	10.0	.....
Sums.....	.....	.....	.....	.....	19.5	.....
Averages.....	.....	96	-20	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	20.7	.....	-20	4.67	.....	.....
Spring months.....	44.8	78	8	17.80	.....	.....
Summer months.....	70.8	95	50	18.37	.....	.....
Autumn months.....	.....	.....	.....	.....	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
MARSHALLTOWN, MARSHALL COUNTY.

BY CHAS. R. BROWN, VOLUNTARY OBSERVER.

MONTH	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction
	Mean.	Maximum.	Minimum.			
January.....	29.2	49	- 5	1.31	5.3	.....
February.....	30.7	54	4	2.24	3.0	.....
March.....	44.7	70	21	3.53	4.2	.....
April.....	53.2	75	36	9.73	.....	.....
May.....	67.2	88	48	3.38	.....	.....
June.....	72.1	90	50	6.66	.....	.....
July.....	70.8	90	48	1.52	.....	.....
August.....	63.4	86	42	1.03	.....	.....
September.....	54.1	83	25	3.71	.....	.....
October.....	33.4	57	8	.32	.....	.....
November.....	17.9	50	-15	1.65	10.5	.....
December.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	90	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	42.9	75	4	15.50	7.2	.....
Spring months.....	70.0	90	48	11.56	.....	.....
Summer months.....	50.3	86	8	5.06	.....	.....
Autumn months.....	.....	.....	.....	.....	.....	.....

\*Maximum and minimum taken from eye readings.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
MAXON, MONROE COUNTY.

BY GEORGE PRICE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	10.0	38	-20	1.52	.....	.....
February....	28.6	50	3	2.16	.....	.....
March.....	32.5	70	5	1.90	.....	.....
April.....	.....	.....	.....	.....	.....	.....
May.....	58.6	82	30	11.38	.....	.....
June.....	74.6	93	50	4.71	.....	.....
July.....	78.8	102	58	5.10	.....	.....
August.....	73.1	95	52	.65	.....	.....
September....	65.7	93	46	1.95	.....	.....
October.....	54.0	87	27	2.58	.....	.....
November....	32.8	60	6	.68	.....	.....
December.....	17.9	51	-19	2.58	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages....	.....	102	-30	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.	20.7	58	-30	5.43	.....	.....
Spring months.	.....	.....	.....	.....	.....	.....
Summer months.	74.8	102	50	10.46	.....	.....
Autumn months.	50.8	93	6	5.21	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
MECHANICSVILLE, CEDAR COUNTY.

BY REV. J. W. HUBBARD, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	20.0	51	-22	1.86	48.0	.....
February....	29.0	61	+ 4	1.32	4.9	.....
March.....	31.4	62	4	3.06	2.0	.....
April.....	45.1	72	22	4.08	2.0	.....
May.....	53.9	75	32	8.97	.....	.....
June.....	67.8	92	49	9.81	.....	.....
July.....	71.4	92	46	4.64	.....	.....
August.....	70.6	.....	.....	2.93	.....	.....
September....	60.0	87	42	.96	.....	.....
October.....	53.0	80	25	.72	.....	.....
November....	31.0	64	5	1.72	6.0	.....
December.....	18.4	42	-17	2.50	20.0	.....
Sums..	.....	.....	-22	42.69	48.7	.....
Averages....	45.6	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.	21.2	51	-22	5.80	38.7	.....
Spring months.	43.5	75	4	16.11	4.0	.....
Summer months.	69.9	92	46	17.38	0	.....
Autumn months.	48.0	87	5	8.40	6.0	.....

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT MONTICELLO,\* JONES COUNTY.

BY H. D. SMITH, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January . . . . .	18.8	46	-21	1.44	6.4	NW
February . . . . .	28.2	50	- 8	1.78	4.1	SE
March . . . . .	30.6	57	6	1.11	1.8	NW
April . . . . .	44.6	74	19	2.70	5.0	S
May . . . . .	54.5	78	32	9.58	.....	NW
June . . . . .	67.8	91	49	8.87	.....	NW
July . . . . .	72.6	95	48	4.30	.....	SS
August . . . . .	70.2	91	45	2.44	.....	SS
September . . . . .	62.0	88	36	2.05	.....	SS
October . . . . .	53.8	81	23	.93	.....	NW
November . . . . .	29.7	50	1	1.43	6.0	NW
December . . . . .	16.4	43	-18	1.95	9.1	NW
Sums . . . . .	.....	.....	.....	38.00	32.4	.....
Averages . . . . .	45.2	66	-21	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months . . . . .	19.6	50	21	4.58	11.8	NW
Spring months . . . . .	43.2	76	6	12.30	6.8	NW
Summer months . . . . .	70	95	43	15.70	.....	S
Autumn months . . . . .	46	86	1	4.42	6.0	NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT MT. AYR, RINGGOLD COUNTY

BY WM. M. SHRIVER, VOLUNTARY OBSERVER.

\*Maximum and minimum taken from eye reading.

ANNUAL SUMMARY ON METEOROLOGICAL OBSERVATIONS AT  
MURRAY, CLARKE COUNTY.

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BY A. W. LEWIS, VOLUNTARY OBSERVER.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
OMAHA, NEBRASKA.

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BY GEO. E. HUNT, OBSERVER UNITED STATES WEATHER BUREAU.



ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
OSAGE,\* MITCHELL COUNTY.

BY G. D. PATTINGILL, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	9.5	..	-22	.43	2.0	NW
February .....	22.5	..	-17	.88	5.0	..
March .....	26.6	..	1	1.94	5.0	NW
April.. ..	41.6	60	21	4.16	8.0	NN
May .....	51.8	..	38	4.87	0.8	NN
June.. ..	63.7	..	..	7.23	..	NE
July .....	69.0	..	..	6.06	..	SE
August. ....	65.6	..	45	2.00	..	SE
September .....	58.0	..	..	1.72	..	S
October.. ..	45.4	..	..	1.49	..	..
November.. ..	27.4	..	8	1.11	1.0	NW
December.. ..	18.6	..	..	1.38	11.5	NW
Sums.....	..	..	..	40.1	32.6	..
Averages. ....	41.6	..	..	..	..	NW
RECAPITULATION BY SEASONS—	..	..	..	..	..	..
Winter months. . . . .	16.2	..	..	2.64	18.5	NW
Spring months.....	39.8	..	1	10.97	13.0	NW E
Summer months.....	61.4	..	..	15.96	0.8	NE E
Autumn months.. ..	43.6	..	..	4.32	1.0	..

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
OSKALOOSA, MAHASKA COUNTY.

BY JOE. BOYD, VOLUNTARY OBSERVER.

MONTH.	Prevailing wind direction.
January.. ..	NW
February.....	NW
March .....	NNW
April.. ..	NNW
May .....	NNW
June .....	NNW
July .....	SW
August.....	SE
September.....	SE
October.....	SW
November.....	NW
December.....	NW
Sums.....	..
Averages.....	NW
RECAPITULATION BY SEASONS—	..
Winter months.....	NW
Spring months.....	NW
Summer months.....	NW SE
Autumn months.....	SE NW SE

\*Maximum and minimum taken from eye readings.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
PANAMA, SHELBY COUNTY.

BY WM. J. WICKS, VOLUNTARY OBSERVER.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
RICHLAND,\* KEOKUK COUNTY.

BY WM. A. SHAFFER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Maximum.	Minimum.	Mean.			
January.....	14.0	.....	.....	1.09	23.0	.....
February.....	27.5	.....	0	1.83	9.4	.....
March.....	29.5	54	4	2.12	1.6	.....
April.....	43.7	62	25	5.06	10.0	.....
May.....	53.8	.....	.....	10.22	.....	.....
June.....	69.6	.....	.....	6.91	.....	.....
July.....	72.3	.....	.....	6.82	.....	.....
August.....	72.0	.....	52	2.02	.....	.....
September.....	61.8	.....	43	.76	.....	.....
October.....	49.3	.....	.....	1.85	.....	.....
November.....	30.6	.....	.....	1.81	7.5	.....
December.....	17.8	.....	-20	2.36	8.5	.....
Sums.....	.....	.....	.....	44.14	50.0	.....
Averages.....	45.2	.....	.....	.....	.....	.....
PRECIPITATION BY SEASONS—						
Winter months.....	20.0	.....	.....	5.66	30.9	.....
Spring months.....	42.2	.....	.....	18.39	11.6	.....
Summer months.....	71.3	.....	.....	15.77	0	.....
Autumn months.....	47.2	.....	.....	4.12	7.5	.....

\*Maximum and minimum taken from eye reading.

## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
SAC CITY, SAC COUNTY.

BY DR. CALEB BROWN, VOLUNTARY OBSERVER.

MONTH	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	18.2	48	-32	.55	8.0	NW
February.....	20.2	46	-12	.55	5.5	NW
March.....	28.7	62	28	1.46	2.0	SE
April.....	44.5	82	28	6.00	5.0	SE
May.....	52.2	75	36	6.00	...	NW
June.....	67.8	96	41	1.50	...	NE
July.....	75.6	95	54	2.06	...	SW
August.....	72.7	92	41	1.25	...	SE
September.....	62.6	89	38	2.62	...	SE
October.....	51.3	83	18	.75	...	NE
November.....	31.3	63	5	.25	T	NW
December.....	13.2	46	-11	1.20	11.0	SW
Sums.....	...	...	...	24.78	29.5	...
Averages.....	44.9	96	-22	...	...	NW
RECAPITULATION BY SEASONS—						
Winter months.....	17.3	48	-32	2.90	21.5	NW
Spring months.....	41.8	75	-22	14.06	8.0	SE
Summer months.....	72.0	96	41	4.80	0	NE SE
Autumn months.....	48.4	89	5	8.62	T	SE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
SIOUX CITY, WOODBURY COUNTY.

BY U. G. PURSELL, OBSERVER UNITED STATES WEATHER BUREAU.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction
	Mean.	Maximum.	Minimum.			
January.....	14.7	46	-32	.21	...	NW
February.....	24.7	41	...	...	...	NW
March.....	31.8	62	...	...	...	NE
April.....	48.5	82	...	...	...	NE
May.....	54	73	...	...	...	NW
June.....	60	94	...	...	...	SE
July.....	75.4	104	...	...	...	SE
August.....	71.8	94	...	...	...	SE
September.....	66.0	9	...	...	...	SE
October.....	44	94	...	...	...	NW
November.....	34.8	62	...	...	...	NW
December.....	20.8	51	...	...	...	S
Sums.....	...	...	...	...	...	...
Averages.....	46.9	101	...	...	...	NW S
RECAPITULATION BY SEASONS—						
Winter months.....	20.1	51	...	...	...	NW
Spring months.....	43.6	73	...	...	...	E NE NW
Summer months.....	72.1	104	...	...	...	S
Autumn months.....	62.1	91	...	...	...	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
STORM LAKE, BUENA VISTA COUNTY

BY A. J. BOND, VOLUNTARY OBSERVER.

## NORTH.

January.....	16.1	64	-28	.31	6.3	..
February.....	23.6	44	-13	.90	6.8	..
March.....	29.8	58	1	1.54	2.6	..
April.....	44.1	74	23	5.84	22.2	..
May.....	52.4	75	32	7.26	0.3	..
June.....	68.2	91	44	2.28	..	..
July.....	74.3	98	50	2.21	..	..
August.....	71.2	96	44	2.77	..	..
September.....	65.3	86	38	.67	..	..
October.....	56.0	86	22	.65	..	..
November.....	23.0	61	6	.25	T	..
December.....	18.4	48	-19	.53	5.5	NW
Sums.....				35.07	40.9	..
Averages.....	45.9	98	-28			..
RECAPITULATION BY SEASONS—						
Winter months.....	19.7	44	-28	IND	15.8	..
Spring months.....	42.1	75	1	14.44	25.1	..
Summer months.....	71.2	98	44	7.26	0	..
Autumn months.....	61.4	86	22	1.57	T	..

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
TIPTON, CEDAR COUNTY.

BY J. M. RIDER, VOLUNTARY OBSERVER.

January.....	16.4	44	-18	.57	5.8	..
February.....	30.1	52	3	.82	2.6	..
March.....	28.4	64	3	2.73	3.5	..
April.....	46.7	74	22	5.57	T	..
May.....	55.3	78	33	9.18	..	..
June.....						..
July.....	74.1	98	46	6.53	..	..
August.....						..
September.....	63.8	90	40	1.90	..	..
October.....	64.3	87	24	.54	..	..
November.....	31.9	56	4	1.81	4.6	..
December.....	19.5	44	-13	2.13	16.0	..
Sums.....			-18		22.3	..
Averages.....						..
RECAPITULATION BY SEASONS—						
Winter months.....	22.9	52	-18	3.63	24.3	..
Spring months.....	43.5	78	3	17.48	3.5	..
Summer months.....						..
Autumn months.....	50.0	90	4	4.15	4.5	..

## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
VINTON,\* BENTON COUNTY

BY T. F. M'CUNE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	14.1	44	-28	.37	3.5	.....
February.....	27.0	49	- 6	1.82	9.0	NW
March.....	31.3	56	3	1.70	5.0	NW
April.....	45.1	.....	.....	4.61	8.0	NW
May.....	54.0	73	39	7.54	.....	SE
June.....	66.8	88	50	4.12	.....	SE
July.....	72.4	90	57	3.86	.....	SE
August.....	69.7	91	46	1.77	.....	NW
September.....	62.6	89	38	2.62	.....	SE
October.....	51.7	83	23	1.51	.....	NW
November.....	31.4	52	6	.73	1.0	NW
December.....	17.2	50	-15	2.00	10.5	NW
Sums..	.....	.....	.....	32.65	37.0	.....
Averages.....	45.3	91	-28	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	19.4	50	-28	4.19	23.0	NW
Spring months.....	43.5	.....	3	13.85	13.0	NW
Summer months.....	69.6	91	46	9.75	0	SE
Autumn months.....	48.6	89	6	4.86	1.0	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WASHINGTON,\* WASHINGTON COUNTY.

BY WM. A. COOK, VOLUNTARY OBSERVER.

MONTHS.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	18.4	54	-19	1.15	.....	NW
February.....	33.1	56	- 1	1.45	.....	NW
March.....	35.4	64	8	3.40	.....	NW
April.....	49.7	73	25	3.79	.....	SE
May.....	59.2	82	40	9.12	.....	SW
June....	75.0	96	53	5.51	.....	NW
July.....	78.7	101	48	3.10	.....	SW
August.....	75.4	98	50	1.27	.....	SW
September.....	66.6	92	44	1.59	.....	SW
October.....	56.1	88	27	1.28	.....	NW
November....	34.8	52	10	1.85	16.0	NW
December.....	22.1	46	-12	1.85	.....	NW
Sums.....	.....	.....	.....	35.36	.....	.....
Averages.....	50.4	101	-19	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months...	24.5	56	-19	4.45	.....	NW
Spring months.....	48.1	82	8	16.31	.....	SE NW SW
Summer months.....	76.4	101	48	9.88	.....	SW
Autumn months.....	52.5	92	10	4.72	.....	NW

\*Maximum and minimum taken from eye readings.

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WEBSTER CITY\*, HAMILTON COUNTY.

BY C. M. TRUMBAUER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	13.1	48	-28	5.1	8.1	.....
February.....	25.2	42	-10	1.53	9.8	.....
March.....	30.0	64	2	2.23	1.0	.....
April.....	42.9	.....	.....	5.68	8.0	.....
May.....	52.0	72	34	6.12	.....	.....
June.....	67.4	96	52	8.31	.....	.....
July.....	72.5	99	56	8.90	.....	.....
August.....	70.9	92	44	2.25	.....	.....
September.....	64.0	90	34	1.00	.....	.....
October.....	52.6	82	22	2.06	.....	.....
November.....	32.6	58	9	.56	.....	.....
December.....	15.5	52	-15	1.87	8.5	.....
<b>Sums.....</b>	.....	.....	.....	<b>35.81</b>	<b>33.4</b>	.....
<b>Averages.....</b>	<b>45.0</b>	<b>90</b>	<b>-28</b>	.....	.....	.....
<b>RECAPITULATION BY SEASONS—</b>						
Winter months.....	18.5	62	-28	4.01	24.4	.....
Spring months.....	41.6	72	2	14.02	9.0	.....
Summer months.....	70.8	96	44	14.16	0	.....
Autumn months.....	49.7	82	9	3.62	0	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WILLIAMS\*, HAMILTON COUNTY.

BY M. L. FULLER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	9.1	45	-32	.28	2.8	NW
February.....	21.4	48	-18	.75	4.5	NW
March.....	27.5	67	2	1.00	1.5	NW
April.....	41.1	58	20	4.74	6.5	NW
May.....	51.0	71	33	6.10	T	NW
June.....	65.3	90	47	8.86	.....	NW
July.....	71.2	96	50	6.78	.....	SE
August.....	68.0	89	44	.71	.....	SE
September.....	60.7	92	36	.22	.....	SE
October.....	47.5	90	19	2.22	.....	SE
November.....	27.6	54	5	.82	T	SE
December.....	12.4	.....	-18	1.41	11.9	W
<b>Sums.....</b>	.....	.....	.....	<b>28.86</b>	<b>27.2</b>	.....
<b>Averages.....</b>	<b>41.9</b>	<b>90</b>	<b>-18</b>	.....	.....	<b>NW</b>
<b>RECAPITULATION BY SEASONS—</b>						
Winter months.....	14.3	.....	-32	2.45	19.2	NW
Spring months.....	39.9	71	2	11.84	8.0	N NE
Summer months.....	68.2	96	44	11.38	0	SE
Autumn months.....	45.3	92	5	3.28	T	S

\*Maximum and minimum taken from eye readings

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WINTERSET, MADISON COUNTY.

BY WILL M'KNIGHT, VOLUNTARY OBSERVER.

						Prevailing wind direction.
Sums .....				37.58	44.0	NW
Averages .....	47.5	100				NW
RECAPITULATION BY SEASONS—						
Winter months .....	22.0	54	-24	3.45	34.5	NW
Spring months ..	44.0	78	6	18.00	9.5	NW
Summer months ..	71.9	100	48	11.08	0	SE
Autumn months ..	52.1	95	7	5.05	2	S

## REVIEW OF THE YEAR 1892.

SUMMARY OF OBSERVATIONS AT CLINTON, IOWA. BY DR. LUKE ROBERTS.

The ushering in of the year 1892 was with overcast sky and the precipitation of rain which had commenced on the evening previous, continuing until 2 P. M. of the 1st, then changed to snow. On this day the wind reached its maximum for the month of January—33 miles an hour. The precipitation for this month was all snow and below normal. The weather was propitious for out of door work, except for the intense cold during the central portion of the month. The ice harvest was satisfactory in quality and quantity. A brilliant meteor with train of fire graced the southwestern sky on the evening of the 26th.

Now comes February with a mean warmth above that of her predecessors which, though agreeable to our bodies, augured no flattering outlook for a fruitful season. The winter months being now ended we will make comparison with the last thirteen seasons. The highest mean temperature for this period was 31°, 1889-90. The lowest was 12.2°, 1884-85. The mean for this period was 21.6°, and for the season ending February 29th, 1892, 26.2°, being 4.6° above normal.

An electric storm of considerable magnitude prevailed on the 13th, extending over a large area of the northern portion of the United States, from the Missouri river to the Atlantic coast. This was visibly manifest in the evening, when a magnificent display of aurora borealis illumed the northern hemisphere. A green segment, whose chord was at an elevation of  $38^{\circ}$ , rested on the northern horizon. Above this, crimson and rose colored beams, occasionally relieved or traversed by changing columns of white and pink, shot up well towards the zenith; sometimes the crimson hues would prevail over a large field, unbroken by lighter shades; then again fade well away but reappear several degrees to the right or left. The intensity of the aurora centralized a little to the east of north, though once loomed in all its glory a little to the west. Fainter portions of the aurora extended nearly to the east and west ends of the segmental chord. Stars were visible through the fiery beams.

The behavior of March was very satisfactory compared with its last thirteen predecessors. The temperature was quite evenly distributed through the month, and normal in degree, while the precipitation was deficient.

On the 9th a blizzard played aerial pranks as it moved eastward at a maximum speed of 28 miles an hour, or a mean of 20 miles an hour for 24 consecutive hours, commencing about 7:00 o'clock A. M. In the meantime the temperature of the air dropped from  $32^{\circ}$  to  $5^{\circ}$  by 11:00 P. M.

April's greeting was warm and balmy and inspired us with pleasant musings on the prospects of early development of the earth's fruitage and the music of the birds. Our pleasant meditations were of short duration, for about 10:00 o'clock A. M. of the first day the elements above betokened radical changes.

At this hour a fresh breeze sprung up which continued to increase, becoming interesting 12 hours later, bringing discomfort to all and damage to some. The storm was of the hurricane type, and gave a specimen of its executive ability by lifting bodily the whole roof of the Kelly manufactory, moving it to the east, and dropping it to the ground in a splintered and demoralized condition. The factory of Anderson & Winter, not 100 feet away, was damaged also. Other minor casualties followed.

This month furnished an excess of rain and much thunder and lightning. On the 3d two horses were killed by lightning while standing near a barn.

On this day was a heavy downpour of rain. The character of the month was such as to retard vegetable growth at least two weeks over normal.

May was below normal in temperature and largely in excess in precipitation, yet there was no downpour or cloud bursts to cause a rush of waters, which would prove disastrous in their haste to escape. Streams about here were not angry with flood-tide, and even the mighty Mississippi was very modest in his zeal to show his breadth and depth and moving power.

Farming interests, however, were somewhat interfered with from the frequent rains. The planting of corn was seriously delayed, and plowing in some sections could not be prosecuted.

June went to a greater extreme in rainfall than May. The precipitation exceeded any previous June in 14 years. On the 18th one inch of rain fell in three hours. On the 22d, 23d and 24th the precipitation was over five



inches. Total for the month, 9.89 inches. The average yearly rainfall is about 36 inches and the month of June furnished over one-fourth of that amount, while the three months April, May and June furnished two-thirds of a yearly rainfall. The excess of rain completely saturated the earth and filled all the streams to overflowing. The Mississippi rose within 17½ inches of the high water mark of 1880, and was the highest since May 15th, 1888. when it lacked only 2 inches of high water mark.

Farming interests suffered seriously; crops were damaged and the condition of cornfields were such that cultivation was impossible in many cases, and weeds and grass choked the corn which struggled for mere existence. Some fields of corn were permanently damaged and made worthless, and the average crop, it was thought, could not be over 60 per cent at maturity.

The character of the weather for July was in every particular calculated to dispel gloom and inspire cheerfulness on the part of those interested in agricultural pursuits, or products of the soil in whatever department, so far as was possible in the nature of things after so late and stormy a season.

While the rainfall was slightly in excess of a July normal, it was well distributed, cloudiness at a minimum and sunshine and warmth in abundance.

On the evening of the 13th aurora lights graced the northern sky. On the evening of the 15th a very interesting display of aurora attracted the attention of many people. The light was somewhat peculiar. While its behavior was in keeping with the average aurora, sending up beams and flashes which sometimes reached the zenith, then retreating and fading and waving to and fro, and anon flashing up again from another point with a broad and luminous base. The peculiarity of the electric storm was its cream-like whiteness, the red being almost wholly wanting except for a few moments. Its base reached from far to the east well around to the west, but the usual arch of the northern horizon was wanting, but in lieu thereof dark cloud-like masses would form, dissolve and reappear in a different place. This electric storm evidently lasted for many hours. During the day the telegraphic instruments were affected so that correspondence at times could not be carried on.

August furnished a higher degree of temperature than is customary for this month. Clear days were also in excess, while the rainfall was deficient, but the conditions were favorable to pasturage and the maturing of ungathered crops. The month closed with a demand for more rain.

September was a fine month, only deficient in rainfall. No killing frost occurred and the corn was safe. There was no time lost in prosecuting the outside industries on account of inclement weather.

October was warm and dry. From the 11th of September to the close of October less than one inch of rain fell. On the 9th the first killing frost of the season occurred.

November was the coldest of the last 14 corresponding months. It was cloudy throughout and somewhat gloomy. On the 25th an icy rain produced a fine foundation for the quiet fall of snow which came on the 27th. The depth of snow was 3 inches and really made good sleighing, which continued to the close of the year, being renewed every few days by light fall of snow all through December.

On the night of 23d-24th, the time predicted for meteoric showers, the sky was overcast except for a brief time during the evening of the 23d, so that a good view of the interesting phenomena could not be had. The few persons who happened to be looking skyward during the break in the clouds pronounced the show fascinatingly interesting, as the darting and fiery meteors were numberless. If the sky had been clear as in some parts of the world, a magnificent view could have been realized, approaching that described by J. Maclair Boraston, while on board the steamer "Don," in longitude  $72^{\circ}$  west and latitude  $17^{\circ}$  north, south of Hayti. He said: "The great elevation of the radiant point, combined with a cloudless tropical sky, the absence of moonlight, and the unobstructed view of the complete hemisphere, afforded the *ne plus ultra* of astronomical requirements.

"Counts were taken at intervals in all parts of the heavens for areas of  $60\frac{1}{2}^{\circ}$  of the visible hemisphere, and for a duration of five minutes each. From those counts which were remarkably equal at all times and in all parts of the heavens eighteen meteors per minute came out as the average per area. As the shower was proceeding with undiminished energy after six hours observation, the total number during these six hours may be set down at 108 per minute for the entire hemisphere, which gives 6,480 per hour, and a grand total of 38,880.

"This is certainly a minimum, for many of the faint, rapid meteors must have escaped notice, a safe inference from the number only just caught before extinction.

"The heavens were alive in all parts, and every variety of meteor present, from the trackless stationary ones in the radiant-point to the luminous pear-shaped "drop" at the horizon, whose tracks often extended from  $20^{\circ}$  to  $30^{\circ}$  in length, and remained visible for roughly ten seconds after extinction of the meteor itself.

"The memory of the 1892 meteoric view will remain long with me. The sight was one of the grandest I ever beheld; the perfect sky setting off the glories of Taurus, Orien, Caus, Agro, and other gems in the great belt, itself crossed in the zenith by the galaxy, full of light; the symmetry in the development of the meteor traces consequent upon the location of the center of radiation directly overhead; the multiplicity of unction and the underlying unity of principle, all tended at once to stimulate and satisfy the mind."

The first zero temperature for the season occurred on the morning of the 11th of December. The lowest temperature for this month was  $-17^{\circ}$ . It was a brisk December and the coldest day of the year was on the 26th. Most of the last decade was cold, snowy and cheerless.

The year 1892 has come and gone, and although the season for seed time and cultivation was unpropitious to a bountiful ingathering, the harvest was near an average, and the granaries and storehouses are supplied with abundance for home needs, and a liberal surplus for the general market, thus proving that intelligent management of farms will never find Iowa begging for bread.

#### SOME WEATHER DETAILS.

Highest temperature,  $96^{\circ}$ ; date, July 25th, 26th, 27th.

Lowest temperature,  $-17^{\circ}$ ; date, December 27th.

Extreme range of temperature,  $113^{\circ}$ .

Mean daily temperature, 46.4°.

Mean daily range of temperature, 20.5°.

Greatest monthly range, 82°, February; least monthly range, 15°, July.

Greatest mean monthly range, 27.5°, October; least mean monthly range, 18.2°, February.

Greatest daily range, 39°, October 10th; least daily range, 3°, February 22d and November 1st, 2d and 28th.

Warmest month, July; mean temperature, 73.2°

Coldest month, January; mean temperature, 15.8°.

Warmest day, June 12th, 83.7°.

Coldest day, December 26th, 6.5°.

Total number of days with the maximum temperature 90° or above, 20.5 in June, 9 in July and 6 in August.

Total number of days with the maximum temperature below 32°, 53.

Total number of days with the minimum temperature below 32°, 138.

Total number of days with the mean temperature below 32°, 98.

Warmest morning at 8 o'clock, July 23, 25, 27, 88°.

Warmest noon, July 25, 26, 27, 88°.

Warmest evening at 8 o'clock, 88°, July 23d.

#### SKY.

Mean daily cloudiness, 47 per cent.

Month with greatest per cent of cloudiness, February, 70 per cent.

Month with least per cent of cloudiness, August, 21 per cent.

Total number of clear days, 105.

Total number of cloudy days, 116.

Month with greatest number of clear days, August, 20.

Month with least number of clear days, February and November, 4 each.

#### PRECIPITATION.

Total depth of snowfall, 22 inches.

Greatest fall of snow at one storm, 5 inches, December 7th.

Total precipitation (rain and snow melted), 40.73 inches.

Greatest rainfall at any one storm, 2.45 inches, June 23d and 28d.

Month with the greatest precipitation, June, 9.39 inches. •

Month with least precipitation, October, .63 inches.

Month with the greatest number of storm days, May and June, 17 each.

Month with the least number of storm days, September and October, 4 each.

Total number of storm days, 98.

#### WIND.

Total movement of wind 43,890 miles.

Maximum velocity per hour, 83 miles.

Greatest monthly movement, 6,270, April.

Least monthly movement, 1,880, August.

Prevailing direction, west.

Observations taken at 8 A. M., noon, and 8 P. M., show the movement of the wind to have been from the north 114 times; from the northeast, 141 times; east, 128 times; from the southeast, 117 times; from the south, 154

times; from the southwest, 155 times; from the west, 160 times; from the northwest, 127 times.

Maximum velocity for January, 23 miles an hour; for February, 18 miles; for March, 30 miles; for April, 28 miles; for May, 27 miles; for June, 33 miles; for July, 20 miles; for August, 16 miles; for September, 11 miles; for October, 29 miles; for November, 24 miles; for December, 18 miles.

#### SNOW AND FROST.

The last spring snow fell on the 21st of March, very light.

The first snow in autumn fell on the 17th of November and was sleety.

Last killing frost in spring on April 29th.

First frost in autumn, October 5th.

First killing frost in autumn, October 9th; temperature, 32°, but of short duration.

Number of consecutive days without killing frost, 162.

The temperature of the air was at the freezing point or below for the last time in spring on the 29th of April.

The first in autumn, October 23d.

The last day when the mean daily temperature was below 32° was April 9th.

The first in autumn, November 7th.

Table showing the yearly mean temperature, rainfall and movement of wind for the years named:

YEARS.	Mean tempera- ture.	Rainfall in inches.	Wind—miles.
1879.....	46.7°	34.18	.....
1880.....	47.1°	38.18	.....
1881.....	46.2°	41.17	.....
1882.....	47.3°	41.18	61,460
1883.....	44.0°	38.71	63,560
1884.....	45.7°	43.40	54,440
1885.....	43.9°	38.21	54,490
1886.....	45.6°	28.71	49,260
1887.....	47.2°	34.01	53,110
1888.....	45.1°	35.80	56,295
1889.....	48.1°	31.98	49,720
1890.....	48.6°	32.62	51,890
1891.....	48.5°	33.87	48,625
1892.....	46.4°	40.73	43,890
Means.....	46.5°	36.48	53,340

#### ELECTO METEORS.

Number of auroras observed, 3. Number of days with thunder and lightning, 24. There were none in January, February, March, October, November and December. In June there were 11 days with thunder and lightning.

#### OPTICAL METEORS.

Number of solar halos observed, 3.

Number of lunar halos observed, 3.

Number of rainbows observed, 1.

Number of meteors observed, 3.

On the 23d of November there was a shower of meteors observed in numbers too great for enumeration.

#### RIVER STATISTICS.

As furnished by Mr. Walden of the C. & N. W. R. R.

On the 10th of March at 9:30 P. M. ice began to move and after several attempts and failures to run out, it finally succeeded in leaving the river free to navigation on the 22d of March.

The first boat to move through the draw was the Ruby, going down at 4:40 P. M.

The last boat to pass the bridge was the Lady Grace, going down at 4:35 P. M., November 21st. The river closed at 9:30 P. M. of this date.

The river was free to navigation 244 days.

During this time there were 3,253 boats passed this point—1,629 went up, 1,624 went down.

Number of barges, 719; number of rafts, 423.

The highest stage of water in the river was 18 feet, 10 inches — June 25th.

The lowest was 3 inches above low water — November 29th.

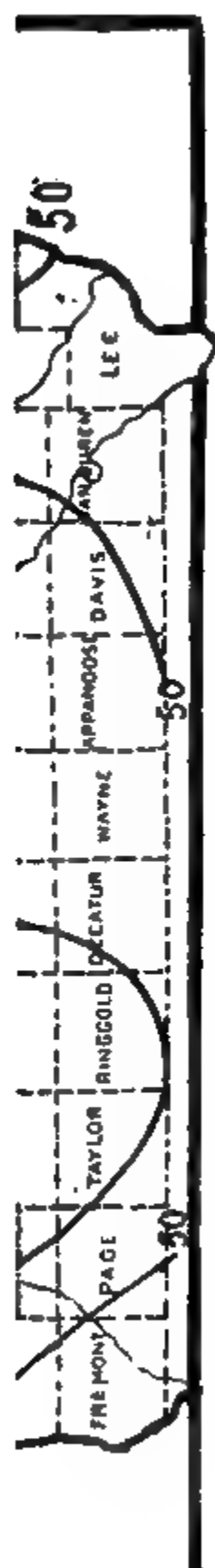
The height of river above low water at the close of the year was 2 feet, 3 inches. At this date the finest of ice 12 inches thick was being harvested for summer use.

Comparative movement of boats for the last 6 years:

YEAR.	Boats.	Barges.	Rafts.
1887.....	2,753	650	564
1888.....	2,627	406	365
1889.....	2,592	531	653
1890.....	3,064	652	538
1891.....	2,821	622	602
1892.....	3,253	719	423

It will be seen that 189 more boats passed this point in 1892 than any other year on this list, and 67 more barges.

AUGUST.				SUM	
Max.	Min.	Mean.	Total precip	Max.	Min.
92	47	70	0.2	71	86
94	42	69.5	4.63	86	
92	43	70	0.2	90	87
93	40	71.8	1.90	95	
102	43	72	1.2	88	90
91	43	68.4	2.85	88	
94	50	72	1.2	53	89
		73.5	2.50		
98	45	70	0.2	04	92
					91
95	47	73	5.1	65	88
90	48	71	5.2	21	92
98	49	75.4	2.07		90
92	42	68	7.1	50	86
		69.3	1.85		91
97	51	74	2.2	85	93
96	46	73	7.1	81	88
90	47	74	6.2	05	92
95	47	71	5.1	95	91
83	40	68.3	2.65		87
93	48	73	0.1	53	90
92	42	69	3.3	09	
95	47	72	0.2	45	92
94	47	72	6.2	51	84
90	42	70	0.2	20	
94	48	71	9.1	04	91
94	40	70	2.2	30	90
98	56	72.2	1.57		83
102	49	74.8	2.95		96
90	45	68.1	4.11		83
94	44	70	7.1	09	93
91	51	72	8.2	15	86
92	42	69.5	1.64		90
89	43	68.4	1.07		90
			3.59		
93	48	71.4	0.91		90
90	48	72	0.2	49	84
98	42	70.5	2.77		90
94	46	69	3.1	92	93
94	44	72	5.2	50	92
95	51	74.8	1.07		90
97	57	74	4.2	32	93
97	42	69	7.4	69	88
97	47	73	6.3	37	95
94	51	70	4.2	27	90
90	48	70	6.1	52	86
91	53	73.2	2.00		85
95	52	73.1	0.85		93
		70	6.2	83	87
91	45	70	2.2	44	88
92	46	71.7	1.15		92
100	49	73	0.2	58	96
	45	65.6	2.69		
94	44	71.6	1.41		94
97	45	69	4.2	48	93
	52	72	0.2	02	
92	41	72	7.1	25	89
95	46	71	8.4	14	91
95	44	71	2.2	27	86
					90
91	46	69	7.1	77	89
98	50	75.4	1.27		92
92	44	70	9.3	25	90
80	44	68	0.0	71	92
96	46	73.2	2.91		96
		71.4	2.29		



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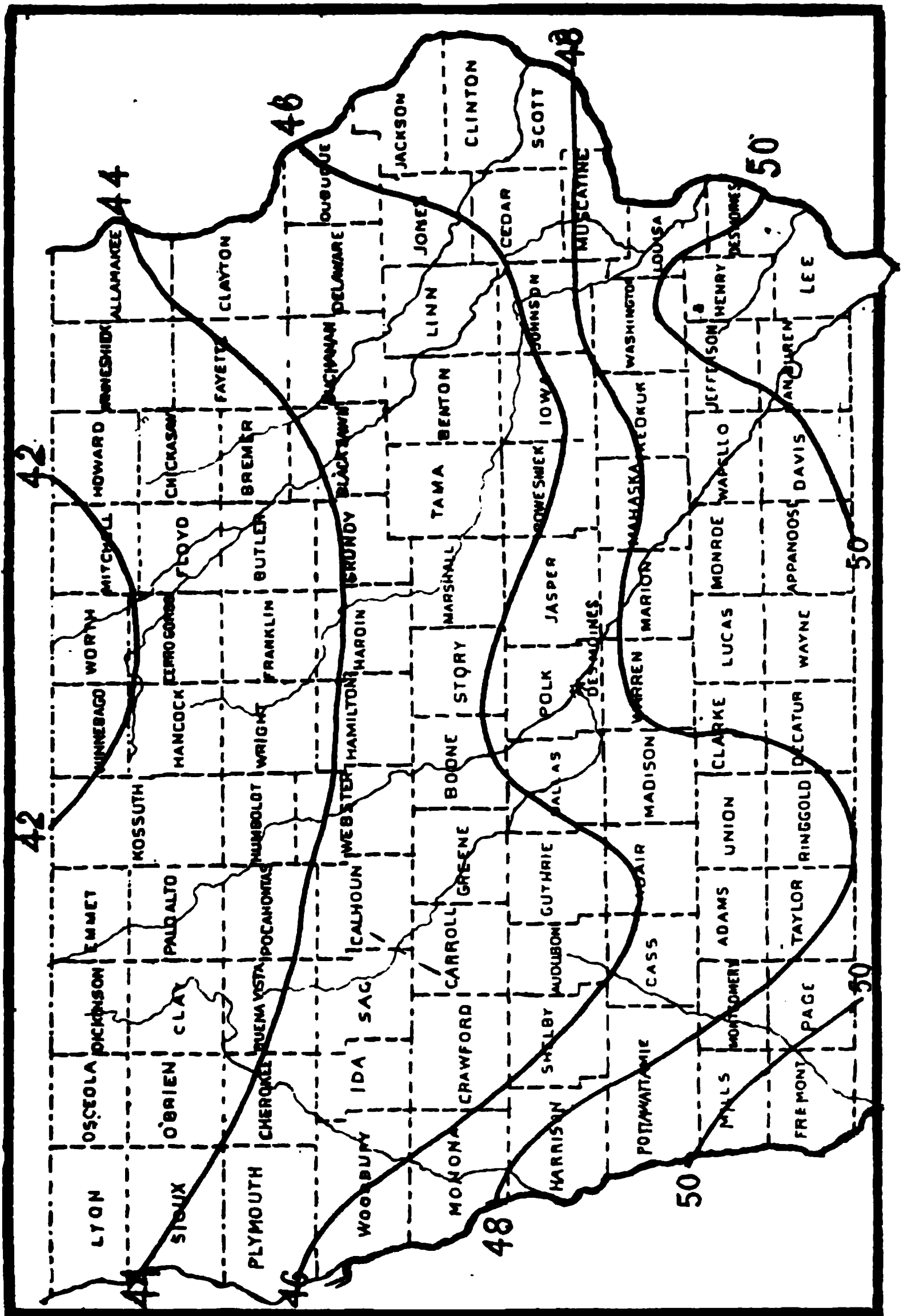
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1887.....	..
1888.....	..
1889.....	..
1890.....	..
1891.....	..
1892.....	..

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# MEAN TEMPERATURE 1892.







PRECIPITATION DATA.

The following table gives the average monthly and annual precipitation (rain and melted snow) in inches, at a number of Iowa stations, covering the records of years named in the last column. The United States Weather Bureau furnished the data from various official sources:

STATIONS.	JAN.	FEB.	MAR.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	ANN'L.	NO. OF YEARS.
Algona.....	.92	1.57	1.52	2.20	3.46	4.62	3.04	3.82	3.24	2.21	1.30	.99	27.77	16
Amana.....	1.51	1.38	2.03	2.45	3.99	4.95	3.88	3.80	3.53	3.13	2.00	1.55	34.07	16
Ames.....	1.22	1.01	1.55	2.43	3.81	4.69	4.51	3.74	3.76	2.32	1.42	1.04	30.96	9
Brookside .....	1.43	1.67	2.43	2.99	4.82	5.78	5.97	5.29	4.60	3.62	2.14	1.36	40.98	10
Brookville.....	1.26	1.26	1.99	3.06	3.83	4.97	2.82	3.39	3.00	2.45	1.77	1.62	32.24	11
Cedar Rapids.....	1.75	1.73	2.45	2.90	4.78	3.86	4.20	3.39	2.68	3.20	1.04	1.69	33.83	8
Cresco.....	1.38	1.00	1.77	2.16	3.47	5.14	4.32	3.13	3.94	2.36	1.50	1.42	31.45	19
Council Bluffs.....	.80	1.18	1.57	2.53	4.59	5.95	5.23	3.34	3.45	3.04	1.10	.99	33.36	13
Clinton.....	1.92	2.32	3.27	3.12	4.47	4.63	4.12	3.63	3.23	2.86	1.96	2.11	37.45	17
Davenport.....	1.74	1.63	2.16	2.75	4.40	4.36	3.81	3.82	3.17	2.96	2.06	1.23	34.70	20
Dubuque.....	1.69	1.56	2.31	2.77	3.96	5.08	4.57	3.49	4.31	3.05	2.14	1.85	37.09	18
Des Moines.....	1.40	1.31	1.45	2.56	4.62	5.95	3.19	3.51	3.40	3.53	1.90	1.40	35.06	13
Denmark.....	1.62	2.22	2.46	2.70	4.42	5.78	3.33	3.52	2.80	3.52	1.81	1.95	35.56	12
Dysart.....	1.24	1.24	1.73	2.11	3.89	4.97	3.75	3.80	4.75	3.13	1.79	1.68	34.30	11
Elkader.....	1.59	1.33	1.77	2.69	3.94	4.21	4.79	3.07	4.17	3.03	1.78	2.37	34.74	12
Fairfield.....	1.75	1.66	2.88	3.21	5.13	5.77	3.65	4.02	3.47	3.37	2.71	1.93	41.31	12
Fort Madison .....	1.90	2.08	2.77	3.13	4.30	4.47	3.90	3.88	3.69	2.98	2.20	1.98	37.58	37
Guttenburg.....	1.14	1.17	1.88	2.33	3.55	5.17	4.62	5.02	3.87	2.34	2.01	1.89	34.18	10
Glenwood.....	1.06	.96	1.46	1.69	5.43	5.32	4.14	3.66	2.39	2.92	1.20	.83	31.73	4
Iowa City.....	1.74	1.55	2.58	3.13	4.21	5.03	4.35	4.67	4.24	3.11	2.64	1.74	39.77	23
Independence.....	1.37	1.05	1.79	2.21	4.17	5.03	4.72	3.43	4.70	2.37	1.52	1.48	33.87	22
Keokuk.....	1.73	1.80	2.16	2.96	4.04	4.92	4.19	3.12	3.53	3.15	2.03	1.96	35.87	20
Le Claire.....	1.58	1.99	2.21	2.74	4.94	5.22	4.09	3.25	3.26	3.49	1.71	1.75	35.20	8
Logan.....	1.30	1.36	2.06	2.63	4.46	5.84	5.41	3.82	3.33	2.61	1.31	1.35	35.51	16
Monticello.....	1.84	1.86	2.50	2.54	3.86	4.51	4.33	3.91	3.94	2.93	2.39	2.39	36.79	37
Muscantine.....	1.81	2.08	2.79	3.41	4.88	4.86	3.91	4.39	3.72	3.04	2.30	2.28	39.22	43
McGregor.....	1.59	1.21	1.90	2.38	3.68	4.96	5.08	3.37	4.04	3.18	1.78	1.79	34.97	16
Nashua.....	1.54	2.23	2.76	2.07	4.19	5.35	6.68	3.87	5.81	3.45	2.34	3.94	45.16	10
Oskaloosa.....	.98	1.11	2.09	2.65	3.43	4.41	3.59	3.12	3.43	2.44	1.82	1.29	31.89	9
Omaha (Neb.).....	.67	.73	1.46	3.11	4.51	5.64	5.15	3.42	3.36	2.77	1.23	1.01	33.06	19
Sac City.....	1.29	1.13	1.56	2.91	4.36	5.38	4.11	3.37	3.46	2.28	1.27	1.28	30.82	15
Waterloo.....	1.18	1.24	1.49	2.00	3.38	3.86	4.05	3.71	4.51	2.27	1.40	1.40	30.76	12
Waukon.....	1.50	1.39	2.21	2.34	3.57	4.83	4.90	3.48	4.41	2.27	1.77	1.74	35.20	.....
Wesley.....	1.14	1.04	1.42	2.30	3.30	4.74	3.50	2.79	3.52	2.17	1.13	2.16	29.60	10
Averages.....	1.37	1.42	2.08	2.60	4.15	4.95	4.30	3.60	3.70	2.85	1.76	1.65	34.88	.....

Total for the six growing months, 23.25 inches.  
Average per month of crop season, 3.90 inches.

## TEMPERATURE DATA.

The following table gives the average monthly and annual mean temperature in degrees, at a number of stations in Iowa, from records covering the number of years in the last column.

STATIONS.	JAN.	FEB.	MAR.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NO. OF YEARS.
Ames .....	16.2	23.5	30.4	49.3	59.1	69.7	75.3	71.4	62.4	49.2	9
Amesbury .....	13.2	20.4	29.6	47.8	59.5	68.9	73.4	69.8	60.6	47.7	14
Algona .....	10.7	17.3	25.5	43.6	50.3	67.7	73.3	70.2	59.9	46.8	11
Brookside .....	12.7	19.9	29.1	45.1	59.0	68.6	73.4	69.9	61.0	46.6	9
Cedar Rapids .....	16.4	21.0	30.8	49.0	57.8	69.4	74.3	70.5	61.1	48.7	9
Clinton .....	19.1	22.7	32.2	47.8	59.5	69.2	73.4	70.6	62.5	49.3	20
Creco .....	9.8	15.4	23.0	43.9	56.4	66.1	70.8	68.5	58.9	45.8	19
Davenport .....	20.8	26.1	34.5	49.8	61.0	70.4	75.0	72.5	64.2	52.1	20
Dubuque .....	18.1	23.3	32.4	48.6	60.2	68.9	74.2	71.5	62.7	50.8	18
Des Moines .....	17.9	23.6	34.2	50.6	60.6	69.9	74.4	72.1	63.6	53.0	18
Elkader .....	11.3	19.4	29.8	47.8	60.9	69.2	73.9	70.0	61.1	47.8	11
Fort Madison .....	23.4	27.6	37.1	51.2	63.0	73.1	77.8	74.5	65.7	52.7	39
Glenwood .....	15.2	22.5	31.2	46.9	57.9	68.4	72.8	70.1	59.1	46.8	16
Guttenburg .....	13.9	20.0	28.7	44.8	57.8	65.7	70.6	67.9	59.6	47.1	17
Independence .....	14.7	21.8	29.9	47.2	59.7	69.1	73.4	70.2	61.8	48.2	24
Iowa City .....	18.9	23.9	33.3	48.1	60.1	68.8	74.1	71.3	63.0	50.3	16
Keokuk .....	23.6	29.1	37.2	51.9	63.8	72.1	77.1	74.4	66.1	54.1	20
Logan .....	18.0	24.8	34.3	49.2	61.0	69.5	74.9	72.5	62.7	51.8	24
Monticello .....	15.4	21.6	31.9	48.3	59.4	69.4	73.9	69.9	61.4	48.9	27
Mount Vernon .....	17.1	21.6	31.6	48.7	60.5	70.4	71.1	71.2	62.0	49.1	12
Muscatine .....	20.2	24.7	35.0	48.9	58.8	69.1	73.0	70.5	62.4	50.3	52
Nashua .....	8.6	15.4	26.9	41.8	54.9	64.7	70.6	66.3	57.1	48.2	7
Omaha (Neb) .....	18.8	25.6	35.4	50.5	62.3	71.1	76.3	74.0	63.9	52.7	19
Oskaloosa .....	16.0	21.0	32.8	49.6	59.7	69.6	75.2	70.9	63.2	49.4	7
Washington .....	16.8	23.7	32.2	50.9	61.1	72.8	77.9	73.8	63.8	51.0	10
Averages .....	16.2	23.2	31.7	48.0	59.7	69.2	74.1	71.0	62.9	49.5	.....

Average for the six growing months of the year, 63.8.

## FINANCIAL STATEMENT.

*Showing the expenditures of the Weather and Crop Service for the year ending June 2, 1893.*

DATE.	Voucher num- ber.	TO WHOM DRAWN.	ON WHAT ACCOUNT.	Amount.
1892.				
June	16	85 Clara S. Baker.....	Clerical service.....	\$ 24.00
June	18	86 J. R. Sage .....	Meteorological instruments.....	49.40
June	30	87 Chase & West.....	Office furniture.. ..	66.00
June	30	88 J. R. Sage .....	Sundry expenses.....	57.75
June	30	89 J. R. Sage .....	Salary for June.....	125.00
June	30	90 Mabel Hogin.....	Clerical work.....	35.00
July	30	91 J. R. Sage .....	Salary for July.....	125.00
July	30	92 Clara S. Baker .....	Clerical service.....	15.00
July	30	93 J. R. Sage .....	Sundry bills.....	44.45
August	31	94 J. R. Sage .....	Salary for August.....	125.00
August	31	95 Mabel Hogin. ....	Clerk hire .....	27.25
August	31	96 J. R. Sage .....	Sundry expenses.....	150.04
September	15	97 J. R. Sage .....	Sundry bills.....	151.70
September	30	98 J. R. Sage .....	Salary for September.....	125.00
September	30	99 Mabel Hogin.....	Clerk hire.....	35.00
September	30	100 J. R. Sage .....	Sundry expenses.....	6.75
October	31	101 J. R. Sage .....	Salary for October.....	125.00
October	31	102 J. R. Sage .....	Sundry expenses.....	15.00
October	31	103 Mabel Hogin.....	Clerk hire.....	35.00
November	30	104 J. R. Sage .....	Salary for November.....	125.00
November	30	105 Mabel Hogin.....	Clerk hire .....	22.00
November	30	106 J. R. Sage .....	Sundry expenses.....	25.00
December	17	107 Iowa Printing Co.....	Printing .....	161.28
December	31	108 J. R. Sage .....	Salary for December ..	125.00
December	31	109 Mabel Hogin.....	Clerk hire.....	29.00
December	31	110 J. R. Sage .....	Sundry bills.....	71.20
1893.				
January	18	111 L. Harbach .....	Furniture.....	55.00
January	31	112 J. R. Sage .....	Salary for January. ...	125.00
January	31	113 Mabel Hogin.....	Clerk hire .....	35.00
January	31	114 J. R. Sage .....	Sundry expenses.....	23.25
February	28	115 J. R. Sage .....	Salary for February.....	125.00
February	28	116 Mabel Hogin.....	Clerk hire .....	35.00
March	31	117 J. R. Sage .....	Salary for March.....	125.00
March	31	118 J. R. Sage .....	Engraving bill.....	14.00
March	31	119 Mabel Hogin.....	Clerk hire .....	35.00
April	29	120 J. R. Sage .....	Salary for April.....	125.00
April	29	121 J. R. Sage .....	Sundry bills.. ..	31.50
April	29	122 Mabel Hogin. ....	Clerk hire .....	40.00
April	29	123 Geo. M. Chappel.....	Traveling expenses.....	12.10
May	26	124 J. R. Sage .....	Salary for May... ..	125.00
May	26	125 Mabel Hogin.....	Clerk hire.....	40.00
May	26	126 J. R. Sage .....	Sundry expenses.. ..	23.50
Total .....				\$ 2,865.17





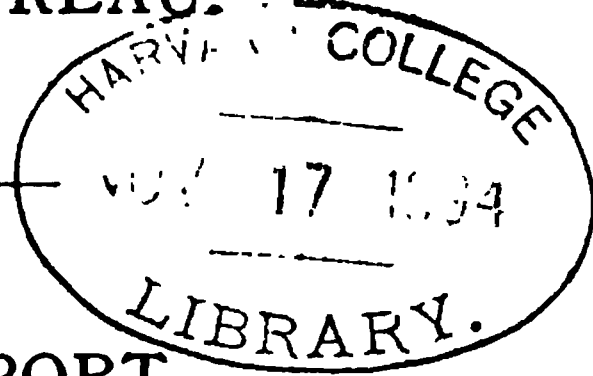








UNITED STATES  
DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU.



ANNUAL REPORT

OF THE

IOWA WEATHER AND CROP SERVICE,  
FOR THE YEAR 1893.

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**J. R. SAGE,**  
*Director.*

**GEO. M. CHAPPEL, M. D.,**  
*Local Forecast Official, U. S. Weather  
Bureau, Assistant Director.*

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1894.



**STATE OF IOWA,  
OFFICE OF THE IOWA WEATHER AND CROP SERVICE, }  
*Des Moines, March 1, 1894.***

***To his Excellency, FRANK D. JACKSON, Governor of Iowa:***

**SIR—In accordance with the requirements of the law, we have the honor to submit herewith the fourth annual report of the Iowa Weather and Crop Service, for the year 1893.**

**We are, sir, very respectfully,**

**Your obedient servants,**

**J. R. SAGE, *Director.***

**GEO. M. CHAPPEL, M. D.,**

***Local Forecast Official, U. S. Weather Bureau, Asst. Director.***



## VOLUNTARY OBSERVERS AND CORRESPONDENTS.

The meteorological data and crop statistics, embodied in this report, were tabulated and summarized at the Central Station from the reports of about twelve hundred voluntary observers and crop correspondents, representing every county in the State. To this body of intelligent and public spirited citizens, whose gratuitous services have been promptly rendered, we are indebted for whatever measure of efficiency has been attained by this bureau. Their compensation consists wholly of the satisfaction resulting from generous acts, and the consciousness that their labors are duly appreciated.

The volunteer corps is divided as follows: 1—The meteorological observers, who keep records and make regular reports of temperature and rainfall at their respective stations. 2—Weather crop observers, from whom reports are received for the weekly bulletins. 3—Crop correspondents, who report acreage and estimates of the condition of crops for the regular monthly summaries, which are published during the season.

## METEOROLOGICAL STATIONS AND OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Albia.....	Gus Johnson.	Davenport... .	* F. J. Walz.
Algona.....	C. D. Pettibone.	Delaware.....	Wm. Ball.
Alta.....	D. E. Hadden.	Decorah.....	L. H. Baker.
Amana ... .	Conrad Schadt.	Denison .....	P. H. Schlumberger.
Ames.....	E. C. Dickinson.	Des Moines.....	*Geo. M. Chappel, M. D.
Ames.....	J. Edgerton.	Dubuque. . . . .	*S. C. Emery.
Ames (4 miles S.W)	Isaac Young.	Eagle Grove. ....	C. A. Schaffter.
Atlantic.....	J. W. Love.	Eldora. ....	Prof. C. F. Woodward.
Audubon.....	J. F. Hocker.	Elkador.. . . .	Chas. Reinecke.
Belle Plaine.....	H. W. Vandike.	Emmetsburg.....	F. S. Appleman.
Blueville.....	James Rodgers.	Fairfield.. . . .	J. Fred Clarke, M. D.
Blockton.....	C. W. Thompson.	Fayette .. . . .	R. Z. Latimer.
Bonaparte.....	Hon. B. R. Vale.	Ft. Madison... .	Miss L. A. McCready.
Carroll ... .	Moses Simon.	Fulton. ....	J. W. Eckles.
Cedar Falls.....	Prof. A. C. Page.	Galva.....	W. A. Crowley.
Cedar Rapids.....	H. D. Olds.	Glenwood.....	Seth Dean.
Centerville.....	Prof. H. E. Reister.	Greenfield.....	J. G. Culver.
Charles City.....	J. W. Smith.	Grinnell. ....	Prof. S. J. Buck.
Clarinda....	A. S. Van Sandt.	Grundy Center....	Chas. G. Rogers.
Clinton... .	Luke Roberts.	Hampton.....	E. C. Grenelle.
College Springs....	A. A. Berry.	Hawkeye.....	J. W. Bopp.
Corning.....	John W. Bixby.	Hopeville.....	M. T. Ashley.
Cresco.....	Gregory Marshall.	Hopkinton.....	Theo. Marks.
Council Bluffs.....	E. W. Hart.	Humboldt.....	J. W. Foster.

## ANNUAL REPORT OF THE

## METEOROLOGICAL STATIONS AND OBSERVERS—CONTINUED,

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Independence.....	E. F. Wulfke.	Osage. ....	G. D. Pattingill.
Indianola.....	Prof. J. L. Tilton.	Oskaloosa.....	Jos. Boyd.
Iowa City.....	Prof. A. L. Arner.	Panama.....	Wm. J. Wicks.
Iowa Falls.....	J. B. Parmelee.	Postville.....	F. L. Williams.
Jefferson.....	Dr. Chas. Enfield.	Richland.....	Wm. A. Shaffer.
Keokuk.....	*Fred Z. Gosewisch.	Rock Rapids.....	W. C. Wyckoff.
Keosauqua.....	Prof. J. H. Landes.	Rockwell City....	G. B. Rigg.
Larrabee.....	H. B. Strever.	Seymour.....	Mrs. C. A. Conger.
Logan.....	Mrs. M. B. Stern.	Sibley.....	H. G. Doolittle.
Mason City.....	H. I. Smith.	Sidney.....	G. V. Swearingen.
Marshalltown....	L. S. Kilborn.	Sioux City.....	*U. G. Pursell.
Maquoketa.....	Dr. A. B. Bowen.	Sac City ...	Dr. C. Brown.
Mechanicsville....	Rev. J. W. Hubbard.	Spirit Lake.....	H. C. Drummond.
Moorar.....	F. G. Thomas.	Storm Lake.....	A. J. Bond.
Monticello....	Henry D. Smith.	Tipton.....	J. M. Rider.
Mount Vernon.....	Prof. A. Collin.	Vinton.....	T. F. McCune.
Mount Ayr.....	Hon. Wm. Shriver.	Villisca.....	M. M. Stoddard.
Murray.....	A. W. Lewis.	Washington.....	Wm. A. Cook.
Muscatine.....	J. P. Walton.	Webster City.....	C. M. Trumbauer.
Newton.....	A. Lufkin.	Winterset.....	Will McKnight.
Omaha, Neb.....	*Geo. E. Hunt.	West Bend....	Phil. Dorweiler.
Ovid.....	H. K. Miller.	Williams.....	M. L. Fuller.

\* U. S. Weather Bureau.

## WEATHER-CROP OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Afton.....	M. V. Ashby.	LeMars.....	Hon. Henry Schrooten.
Agency.....	J. H. Van Zant.	Ledyard.....	Frank Miller.
Albia.....	Wm. Mercer.	Lawler.....	Hon. Wm. Glattly.
Alta.....	Hon. H. T. Saberson.	Lockridge.....	John F. Farman.
Ames.....	Henry C. Wallace.	Manning.....	W. H. Pollock.
Anita.....	H. T. Chapin.	Mapleton.....	A. Lamb.
Ankeny.....	Ed. Parmenter.	Marshalltown....	Hon. J. G. Brown.
Battle Creek.....	A. Preston.	Mason City.....	Wm. Nettleton.
Bloomfield.....	Geo. Duffield.	Mt. Pleasant.....	W. S. Wright.
Boone.....	L. C. Morris.	Milton.....	Hon. E. C. Holland.
Carbon.....	N. M. King.	Mount Vernon....	Robert Smith.
Carson.....	G. N. Ferguson.	Newton.....	Hon. J. P. Beatty.
Centerville.....	Henry Galley.	North English....	J. L. Williams.
Charles City.....	W. B. Towner.	Nevada.....	O. G. Ashford.
Chariton.....	C. C. Burr.	Osage.....	E. W. Stacy.
Clarksville.....	F. M. Russell.	Orange City.....	H. J. Vande Waa.
Corning.....	Jerome Smith.	Paton.....	Hon. Joshua Jester.
Clermont.....	Chas. Larabee.	Pittsburg.....	G. C. Duffield.
Concord.....	J. M. Elder.	Polo Station..	A. E. Miller.
Council Bluffs....	L. Prouty.	Prescott.....	G. W. Iden.
Dedham.....	J. W. Kay.	Paullina.....	Geo. Hakeman.
Danville.....	Sherman Matthews.	Rockwell City....	J. G. Palmer.
Emerson.....	D. B. Nims.	Rock Rapids....	D. E. F. Merrill.
Ely.....	Hon. A. J. Fuhrmeister.	Rossville.....	F. B. Wiley.
Fontanelle.....	W. H. Bridgman.	Sandusky.....	Z. Hollingsworth.
Ford.....	W. W. Whitmore.	Sageville.....	Hon. F. N. Knoll.
Fort Dodge.....	R. W. Blaine.	Shenandoah.....	Reuben Mullison.
Geneva.....	Wm. H. Thompson.	State Center.....	E. N. Thompson.
Gosport.....	B. F. Banta.	Sumner.....	John Dawson.
Grand River.....	Dr. John Daykin.	Tama.....	W. G. Malin.
Grinnell.....	A. O. Price.	Van Horn.....	Spencer Smith.
Harlan.....	Fred Fischer.	Wapello.....	O. P. Smith.
Hesper.....	G. E. Dillingham.	Waukee.....	John Wragg.
Hodge.....	James Piper.	Wheatland.....	D. Beckman.
Hamlin.....	F. P. Moore.	Willow Creek....	W. S. Nicholson.
Humeston.....	Hon. S. H. Moore.	Winterset.....	H. A. Kinsman.
Independence.....	C. L. Thomas.	Wall Lake.....	T. E. Wilcox.
Indianola.....	T. B. Hammer.	Walnut.....	F. L. Martin.
Jefferson.....	S. M. Taylor.	What Cheer....	O. D. Lawrence.
Larrabee.....	H. H. Carnahan.		

## PUBLICATIONS.

During the crop season—April 1 to October 1—twenty-five weekly Weather-Crop Bulletins were issued. The average weekly issue was about 1,800, making the total for the season 45,000 copies. The summaries were published in the leading daily and weekly newspapers of the State, and circulated throughout the country by associated press and news specials, thereby giving them a wide dissemination.

The total number of copies of the Monthly Review issued during the year was about 25,800. The demand for this publication is constantly increasing. Monthly crop reports were published in the Review for the months of June, July, August and September, and the final report of the season was tabulated and issued in the November number. The crop reports were also given wide publicity through the columns of the daily and weekly press.

## DISPLAY STATIONS.

Through the agency of this bureau, the daily weather forecasts of the U. S. Weather Bureau, and of the local forecast official at the central station for the State of Iowa, have been widely disseminated by means of weather maps and through the agency of display stations. There were 79 display stations to which forecast telegrams were sent during the year. Arrangements have been completed for a greatly increased dissemination of forecasts by means of postal cards sent out from some of the principal points of distribution.

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GENERAL REVIEW OF THE YEAR.

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The mean atmospheric pressure for the year 1898, for the State, was 30.02 inches, which is about the normal amount. The highest barometer reading (corrected for elevation, etc.) for the year, was 31.04 inches at Cresco Howard county, February 3. The lowest observed was 28.80 inches at Davenport, April 20.

The mean temperature for the year was 45.7°, which is about 1.8° below the normal for the State. The average temperature was brought down by the extreme cold of the two winter months—January and February—and abnormally cool weather of April and May. The balance of the year was warm enough to bring the annual mean up to nearly the normal figure. The summer and autumn were favorable for the growth, ripening and harvesting of the corn crop, which was better than an average. The highest temperature reported was 102°, on July 13 and 14 at Ames and Atlantic. The minimum temperature for the year was 28° below zero, on February 4 at Charles City. The range for the State was 180°.

The average precipitation for the State was 27.31 inches, or about 3 inches below the normal, the distribution of which is shown by the accompanying precipitation chart. The heaviest monthly rainfall reported was 8.84 inches at Clarinda in July. The least monthly total was .02 of an



inch at Algona in October. The greatest amount reported for any 24 consecutive hours was 3.60 inches at Atlantic on June 9th. It was regarded as a drouthy summer for Iowa, and yet the total average rainfall for the four crop months—May, June, July and August—was 18.01 inches. Those critical crop months gave us nearly one-half the total rainfall of the year. It is that climatic feature which makes the corn and saves the bacon in Iowa!

The prevailing wind direction was northwest. Maximum velocity reported 64 miles an hour from the northwest at Sioux City, on May 21st. For the whole State there were 98 clear days during the year; 108 partly cloudy, and 164 cloudy days. The number of stormy days, on which .01 of an inch or more of precipitation fell, was 78.

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## MONTHLY WEATHER SUMMARY.

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### JANUARY.

The mean pressure of the air for the month was 30.13 inches. The highest observed was 30.61 inches at Omaha, on the 15th, and the lowest 29.55 inches, at Sioux City, on the 21st.

The daily mean temperature of the State was  $9.8^{\circ}$ , which is about  $7^{\circ}$  below the normal, giving it rank among the coldest winter months on record in Iowa. The mean temperature at Des Moines has been lower in two Januarys since the station was established. At Davenport and Dubuque the mean was as low as has been noted within the past twenty-two years. The lowest temperature reported was  $34^{\circ}$  below zero at Decorah, January 14th.

The average precipitation, .74 of an inch, was about half the normal amount. The greatest amount reported was 3.20 inches at Havelock, and the least amount was 0.13 at Larrabee.

### OBSERVERS' NOTES.

*Monticello*—HENRY D. SMITH. There was a faint solar halo, two sun-dogs at sunrise January 18th, and a bright lunar halo from 7 to 8:30 P. M., on the 29th. Frost every day. The maximum temperature for January since 1854 was  $62^{\circ}$  in 1855; minimum— $33^{\circ}$  in 1884. The normal for the month is  $14.77^{\circ}$ . The maximum precipitation for the month was 3.77 inches, in 1886; minimum 0.29, in 1865; normal, 1.65 inches. The maximum snowfall was  $28\frac{1}{2}$  inches in 1861; minimum, .00, in 1857; normal, 8.43 inches. The years of lowest mean temperature for January were 1875,  $3.6^{\circ}$ ; 1883,  $6.41^{\circ}$ ; 1885,  $5.9^{\circ}$ ; 1888,  $6.76^{\circ}$ .

*Fort Dodge*—R. W. BLAIN. Weather record for January, 1893. Number of clear days, 9; partly cloudy, 9; cloudy, 13. Temperature below zero at 7 A. M., 13 times; below at 1 P. M., two days. Lowest temperature observed,  $14^{\circ}$  below zero; highest,  $33^{\circ}$  above. Wind blew at a velocity of 20 miles an hour one day; at 15 miles one day, and at 10 miles three days. Snowfall,  $4\frac{1}{2}$  inches, badly drifted.

*Fayette*—R. Z. LATIMER. Mean temperature for the month,  $6^{\circ}$ . Mean max. temperature for the month,  $16^{\circ}$ . Mean min. temperature for the month,  $5.45^{\circ}$ . Maximum temperature on the 9th,  $32^{\circ}$ . Minimum temperature on the 17th,  $24^{\circ}$  below. Twenty-two days in the month the temperature dropped below zero, and on the 9th, 14th and 26th the temperature did not reach above zero. Total precipitation (melted snow), 1.05 inches. Depth of snow on the ground on the 15th, 18 inches. Depth of snow on the ground at the end of the month, 19 inches. Snow fall during the month, 12.2 inches. Prevailing wind, northwest. Number of clear days, 11; partly cloudy, 7; cloudy, 13. Observation taken at 7 A. M. showed the temperature below zero 16 times, at 1 P. M. 4 times, and at 9 P. M. 12 times.

*Clarinda*—A. S. VANSANDT. January, 1898, was the coldest month since records of this station began—1898.

*Clinton*—LUKE ROBERTS, M. D. January, 1898, was one of the coldest Januarys. Since 1889, that of 1883 was a record breaker in severity, but in its monthly mean only went  $.3^{\circ}$  below that of 1898. The first month of 1898 was continuously cold throughout, the highest temperature reaching  $39^{\circ}$ ; this was on the 24th. The temperature was below zero on twenty different days during the month, ten of these being consecutive, from the 10th to the 19th inclusive. The customary January thaw did not put in an appearance. The ground was continuously covered with snow, and fine sleighing prevailed during the entire month. On the 28th a steady misty rain continued all day, forming a crust on the snow, and ice on trees and shrubbery. Walking became difficult and dangerous. The balance sheet of January showed a large reserve of frigidity, which was carried over into February, and only exhausted after a ten days' run.

#### FEBRUARY.

The mean pressure for February was 30.18 inches. On the 3d the barometer at Cresco indicated 31.04 inches. Lowest for the month, 29.37 at Cresco on the 27th.

The mean temperature was  $16.4^{\circ}$ , which is about  $6^{\circ}$  below the normal for the State. Following two extremely cold months February closed the record of one of the coldest winters ever experienced in this State. The lowest temperature reported was  $28^{\circ}$  below zero at Charles City on the 4th.

The average precipitation for the State, 1.89 inches, was but little below the normal for the month. There were two severe storm periods, viz., on the 6th and 7th, and on the 26th, 27th and 28th. The notable feature of the latter period was the quite general electric storm of the 27th. It was a heavy storm of snow and sleet, with temperature below freezing, accompanied by vivid lightning and heavy thunder. At Boone at the hour of 4:30 A. M., the residence of E. H. Burlingame was struck by lightning and nearly demolished. The inmates were not injured.

Thunder storms occurred quite generally throughout the State on that day. There were ten cloudless days during the month.

#### OBSERVER'S NOTES.

*Algona*.—C. D. PETTIBONE: On the morning of the 27th occurred an unusual electric storm, commencing at 5:30 and continuing until 10 A. M. The lightning was vivid and thunder heavy amid a terrific snow storm. The snow coming down like rain in summer under like atmospheric conditions. Telegraphic instruments were useless for several hours.

*Bonaparte.*—HON. B. R. VALE: The ground has been practically covered with snow or ice all the month. Winter grain on corn ground is still covered. In this locality the ground has been protected by snow or ice since November 17th.

*Clinton.*—DR. LUKE ROBERTS: The rigorous winter weather which characterized the first decade of February, 1893, was a continuation of that which January had furnished, and was equal in mean temperature, and phenomenally unstable.

*Williams.*—M. L. FULLER: A thunder-storm, with unusually frequent discharges of lightning, occurred on the 27th, from 4 to 8 A. M. The duration, frequency of discharge and heavy precipitation, made this a noteworthy storm, though no damage resulted. The storm was preceded by a light fall of fine, floury snow on the 26th. The thunder was first heard at 4 A. M. on the 27th, and the discharges continued at intervals of 3 to 6 minutes till 7:30 A. M. It was accompanied by a fall of dry pellets of snow and ice.

*Osage.*—G. D. PATTINGILL: On the 27th, from 7:10 to 7:30 A. M., there were brilliant discharges of lightning, followed by loud thunder, and during all the time snow was falling very fast in large flakes. The thermometer stood at about 20°. The only rainfall of the month occurred on that date, continuing from 11 A. M. to 6 P. M., followed by snow.

*Fayette.*—R. Z. LATIMER: Summary of observations for February: Mean temperature for the month, 14°; maximum temperature, 38° on the 27th; minimum temperature, 22° below, on the 4th. Nine days in the month temperature dropped below zero, and on the 1st, 3d, 6th and 7th, the temperature did not reach above zero. Total precipitation (including melted snow, 1.26 inches. Snow fall during the month, 9.45 inches. Depth of snow on the ground on the 15th, 14 inches. Depth of snow on the ground at the end of the month, 12 inches. Prevailing wind, northwest. Number of days clear, 13; partly cloudy, 8; cloudy, 12. Observation taken at 7 A. M. showed the temperature below zero nine times; at 1 P. M. four times and at 9 P. M. four times. One sharp flash of lightning and heavy peal of thunder during the snow storm on the morning of the 27th.

*Monticello.*—HENRY D. SMITH: The mean temperature of the three winter months (1892-3) was about 7° below the normal. Since 1854 there has been seven other colder winters.

The depth of snowfall for the last winter was 37 inches, 11.5 inches above a normal for the last fourteen winters. But two winters in the time given furnished more snow.

Good sleighing prevailed during the winter just closed, without a day's interruption.

This was not wholly due to the amount of snow, but rendered possible by the continuous cold and the snowfall occurring at frequent intervals.

Continuous sleighing for so great a number of consecutive days is without a parallel in eastern Iowa, so far as I have information.

Roads were exceptionally good during these three months, and business was greatly benefited thereby.

The maximum temperature for February, 1893, was lower than any of its predecessors for the fifteen years mentioned.

The coldest day of the month was the 7th, with a mean temperature of 10° below zero.

The warmest day was the 27th, with a mean temperature of  $38.3^{\circ}$ . The range of temperature for this day was only  $8^{\circ}$ , the least for the month.

The number of storm days was 8, all of which were light, only one reaching one-half inch. Total precipitation (snow melted), 1.68 inches; 12 inches was the depth of snowfall. On the 15th there was remaining on the ground 11 inches of snow, and at the close of the month, 10 inches.

#### MARCH.

The mean pressure for the month was 30.04 inches. Highest recorded, 30.75 inches at Clarinda on the 15th. Lowest, 29.14 inches at Davenport on the 8th.

Very nearly normal weather conditions prevailed during the month, the mean temperature being  $31.7^{\circ}$ , and the average precipitation 2.14 inches. The highest temperature reported was  $84^{\circ}$  at Glenwood on the 30th, and the lowest  $8^{\circ}$  below zero at Alta and Eagle Grove on the 4th. The average number of cloudy days was 11, partly cloudy 10, and clear 9. The closing days were favorable to plowing and seeding.

#### OBSERVERS' NOTES.

*Belle Plaine.*—H. W. VANDIKE: Robins were first heard on the 2d, bluebirds on the 9th and wild geese on the 10th.

*College Springs.*—A. A. BERRY: The first thunder-storm of the season took place on the 7th, accompanied by 0.22 inch of rain. Everything prosperous for the farmers. Fall wheat looking well.

*Cedar Rapids.*—H. D. OLDS: At close of the month frost was out of the ground, and the weather was extremely favorable for plowing and early seeding.

*Denison.*—PH. SCHLUMBERGER: Wild geese were first seen on the 9th, robins and bluebirds on the 10th.

*Clinton.*—DR. LUKE ROBERTS: March furnished no special phenomena. The temperature was slightly above normal and also the precipitation. The movement of the wind was below normal. The mildness of this month encouraged us to look for an early spring, but we looked in vain.

#### APRIL.

The mean barometric pressure for this month was 29.89 inches. The highest observed was 30.32 inches at Sioux City and Cresco on the 11th; lowest, 28.80 inches at Davenport on the 20th.

The month of April, 1893, was abnormally cold, wet and cloudy. The first decade was warm, dry, and unusually favorable. The second decade was cold, wet, and backward, and the third was the coldest period of the month. The mean temperature,  $45.5^{\circ}$ , was about  $4^{\circ}$  below the normal. The average precipitation, 4.21 inches, was about 1.50 above the seasonable average. Thunder-storms occurred at numerous points on the 3d, 11th, 26th and 28th. Hail fell at Audubon on the 7th; Blakeville, 6th; Centerville, 3d and 11th; Des Moines, 11th; Indianola, 26th; Panama, 11th and 26th.

#### SEVERE LOCAL STORMS.

The month of April was characterized by severe and destructive storms in all parts of the country, and Iowa received a small but sufficient share of these unwelcome visitations. The first notable storm period began on the 11th, on which date a "low," or cyclonic disturbance of great propor-

tions and unusual activity, passed across the upper Mississippi valley, the track of its center crossing near the northwest corner of the State, in a northeasterly course. It was accompanied by heavy rains and dangerous winds, and the local forecast for Iowa—severe local storms—was fully verified. The bulk of the State was in the southeast quadrant, the dangerous region, but it was too near the center to receive the worst effects of the storm. There were numerous wind squalls of considerable destructiveness, and reports indicate that in a number of places within the State small and short-lived tornadoes were developed. The town of Akron, Plymouth county, was in the line of a heavy wind storm on the afternoon of the 11th, and a number of houses and business buildings were demolished. Estimated loss, \$50,000, but no lives were lost.

A heavy wind storm, probably a tornado, passed through the townships of Williams and Butler in Calhoun county, and also visited Colfax township, Pocahontas county. The track of the storm was about eighty rods in width, and the damage to property is estimated at \$6,000 to \$8,000. No lives were lost, but four people received severe injuries.

On the same date a small but vigorous cyclone swept a narrow area in Jasper county, passing in a northeasterly direction near Adamson's Grove, about 5 miles northeast of Newton. The destruction of property was comparatively light, but sufficiently heavy for the people who were directly in its pathway. No lives were lost, but one man, a Mr. Hoskins, whose house was demolished, was badly injured, one leg being broken by a falling timber. The storm lifted and disappeared after traversing a short distance.

The second noteworthy storm period covered the dates of April 19th, 20th and 21st. It began with heavy rain and terminated in a snow storm, accompanied by a high and cold wind from the northwest, giving it the character of a blizzard. In the northern districts the snow was so heavy and drifted so badly that railway trains were delayed on nearly all the lines traversing that section. The track of its center passed south of Iowa and consequently there was no development of tornadoes within the State. But it was an unusually severe storm for the season of the year, and resultant loss of young stock was quite serious. It was followed by freezing temperature, the minimum recorded at the central station being 22 degrees. Fruit buds were generally not far enough advanced to be badly damaged by the low temperature.

On the morning of April 24, the M. E. church at Orient was struck by lightning and considerably damaged.

On the 11th Mrs. Daniel Heldt, residing near Geneva, Franklin county, was killed by lightning.

#### OBSERVERS' NOTES.

*Clinton.*—DR. LUKE ROBERTS: April, 1891, was of seasonable warmth and fairness for the first fourteen days, and furnished favorable conditions for seeding and preparation of the soil for planting, and the farmers utilized every day to the best advantage. The remainder of the month was almost wholly cloudy with frequent showers and chilly temperature.

Field work was greatly retarded and vegetable growth almost at a stand. Fruit trees were belated, grass of slow growth and horticultural pursuits embarrassed. The hindrances to cultivating the soil and to the growth of vegetation was not so much due to the amount of precipitation as to its constant drizzle, lack of sunshine and low temperature.

The last day of the month was colder than the first. By decades the mean daily temperature was as follows:

First decade,  $53.8^{\circ}$ ; second decade,  $45.3^{\circ}$ ; third decade,  $41.4^{\circ}$ . The highest temperature for the month was  $87^{\circ}$ — $4.1^{\circ}$  above normal. Minimum temperature was  $24^{\circ}$ — $2.8^{\circ}$  above normal. The mean temperature for the month was  $46.7^{\circ}$ — $4.6^{\circ}$  below normal, and the same as in 1892. The warmest day was the 7th, mean temperature,  $68.8^{\circ}$ — $2.6^{\circ}$  above normal. The coldest day was the 21st, mean temperature,  $35.5^{\circ}$ . Notwithstanding the maximum and minimum temperature, the temperature of the warmest and coldest day was above normal, the mean for the month was far below.

*Bonaparte.*—HON. B. R. VALE: The first half of the month was favorable for agriculture, but the last half has brought farm work and the growth of vegetation to a stand still.

*College Springs.*—A. A. BERRY: First part of month warm and dry; last half, cold and wet, retarding farm work and the growth of vegetation. Pig crop will be as short as last year, or less, owing to various causes. Fall wheat looking better, and will be about an average crop, but about 20 per cent less than last year.

#### MAY.

The mean pressure for the month was 29.91 inches; the highest observed being 30.81 inches, at Dubuque, on the 7th, and the lowest, 29.36 inches, at Davenport.

The mean temperature of the State was  $56.6^{\circ}$ , which is about  $3^{\circ}$  below the normal for May.

The average precipitation was 3.45, or about .70 of an inch below the normal. It was, however, fairly well distributed, and ample for the needs of agriculture.

The month brought its usual quota of severe storms of a local character. The periods of greatest storm energy were about the 10th and 11th, and the 21st and 22d.

On the night of the 10th a wind squall passed three miles west of Dunlap. It was accompanied by hail in streaks, and a number of buildings were damaged. The same storm swept through Charter Oak, Crawford county. On the same night severe storms were reported at Williams, Hamilton county; Iowa Falls, Hardin county; Coon Rapids and Grundy Center. At Council Bluffs D. W. Patterson was killed by lightning, and at Burt, J. B. Jones was the victim of the same deadly force.

The storm of the 21st and 22d was especially severe at Nora Springs, Armstrong, Hastings, Holstein, Hampton, Goldfield, Gilmore City, Alta and Sioux City. These disturbances were of the usual character of summer thunder squalls. No tornado visited Iowa during the month.

#### OBSERVERS' NOTES.

*Clinton.*—DR. LUKE ROBERTS: The first seven days of May, 1893, were cool, the minimum temperature ranging between  $31^{\circ}$  and  $39^{\circ}$ . A little rain on the 1st, frost on the 3d, and frost and rain on the 4th, and frost on the 6th. These frosts were light and the only frosts of the month. The range of the minimum temperature for the remainder of the month was between  $38^{\circ}$  and  $62^{\circ}$ . The  $38^{\circ}$  mark was reached only once—on the 18th, and on the 22d it touched  $68^{\circ}$ .



The lowest maximum temperature was  $50^{\circ}$ , on the 1st and 5th, and the highest maximum temperature was  $86^{\circ}$ , on the 10th. It was also above  $80^{\circ}$  on the 19th, 20th, 21st, 22d, 29th and 30th. The maximum temperature was  $4^{\circ}$  below normal. The highest for May during the last twelve years was  $92^{\circ}$ , in 1889.

The mean temperature for the month was  $57.3^{\circ}$ ;  $2.3^{\circ}$  above normal. The highest monthly mean for May during the last fifteen years was  $66.9^{\circ}$ , in 1887, and the lowest mean for the same period was  $52.2^{\circ}$ , in 1888. The warmest day was the 21st, the mean temperature being  $70.2^{\circ}$ . The warmest May day during the last 15 years was the 28th, in 1881, the mean temperature being  $79^{\circ}$ . The coldest May day for the same period was the 7th, in 1885, the mean being  $37.5^{\circ}$ .

The rainfall for the month was 3.8 inches. This is .70 inches below a fifteen years' normal. The greatest monthly rainfall for May during the last fifteen years was 8.41 inches. This was in 1892.

The number of storm days in the month was twelve and the greatest precipitation during twelve consecutive hours was 1.30 inches, this was on the 31st, commencing at 1 P. M. and ending at midnight.

There were eight cloudy and eight clear days, all being a little above normal. Cloudiness was 50 per cent of the surface of the sky, or 2 per cent above normal.

The prevailing direction of the wind was northwest, which was something unusual for May, as it has not occurred before during the last fifteen years. The total movement of the wind for the month was 4,700 miles; this was about a May normal. Maximum velocity, 23 miles an hour. For about five minutes during the storm of the 31st it must have exceeded that somewhat, but the duration was so short that an accurate measurement could not be had.

*Monticello.*—HENRY D. SMITH: Corn planting began the 8th; strawberries in blossom, 9th; currants and gooseberries, 14th; apple blossom, 19th, in full bloom, 22d.

#### JUNE.

The mean barometric pressure for the month was 29.93 inches. The highest observed was 30.28 inches, at Keokuk on the 7th; lowest, 29.54 inches, at Davenport, on the 1st.

June was an ideal month, favorable to all forms of life. The monthly mean temperature,  $71.2^{\circ}$ , was about  $2^{\circ}$  above the normal for the State. The average rainfall, 3.91 inches, was about 1.00 inch below the normal amount, but it was fairly well distributed and gave ample moisture to nearly all parts of the State.

The elements were generally propitious during the month, and less than the usual June quota of severe local storms have been reported. On the evening of the 10th a wind storm, accompanied by hail, visited the country three miles west of Dunlap, touching portions of Harrison and Crawford counties. Several buildings were injured, and a barn belonging to Carl Remley was destroyed and some stock killed.

In the northwestern part of Guthrie county considerable damage to crops was done by hail on the 23d. It is described as a destructive storm, from three to six miles wide, and the hail from four to six inches deep. Corn and small grain in its pathway were completely ruined. A hail storm

of small extent is reported from Defiance, Shelby county, on the 21st of June.

#### OBSERVERS' NOTES.

*Clinton.*—DR. LUKE ROBERTS: There were no meteorological excesses chargeable to June, 1893. All conditions were favorable to the growth of agricultural and horticultural products. This was very gratifying, as the season was some days later at the commencement of the month. Corn, oats, potatoes, meadow grass and pastures, as well as small fruits, flourished almost without a precedent, so that at the close of the month they were found up to an average in their race toward maturity.

The mean temperature for the month was  $71.2^{\circ}$ , being  $2.1^{\circ}$  above normal. The maximum temperature was  $92^{\circ}$ ; this was  $3.9^{\circ}$  below normal, while the minimum was  $4.5^{\circ}$  above normal, being  $48^{\circ}$ . Only one June during the last twelve years furnished a higher minimum, that was 1892,  $51^{\circ}$ . The lowest June minimum for the last twelve years was  $38^{\circ}$ , in 1892. The coldest day was the 1st, being  $59^{\circ}$  mean temperature, an excess of  $4^{\circ}$  above a mean of coldest June days. The warmest day was the 19th, the mean being  $80.7^{\circ}$ ; this was also above the average warmest June days.

The number of storms was ten, one less than a June average. All storms were light.

The per cent of cloudiness was low and the number of clear days was in excess of a June normal by 7.4 days.

The prevailing direction of the wind was southeast, and yet it was more nearly equal from all points of the compass than a monthly average. The total movement of wind was 2,660 miles. This was a little below a June average.

The total rainfall for the month was 3.22 inches. This was 1.85 inches below a June average.

*Bonaparte.*—B. R. VALE: Since the first week the month was favorable and properly improved in agriculture; no very serious storms.

*Cedar Rapids.*—H. D. OLDS: The mean temperature for June has been two degrees above the normal. Rainfall near the average for past ten years. No damage by storms during the month—several have passed at a distance. Crops of all kinds are looking fine.

*College Springs.*—A. A. BERRY: A very satisfactory month, and crops have made good growth and promise a bountiful harvest; better than last year, except apples, which are about the same. Hay an average. Pasture above an average. All stock looking well. Fall wheat a little less than last. Corn ten days earlier than last year and very clean.

#### JULY.

The mean pressure for the month was 29.95 inches. Highest, 30.23 inches, at Clarinda, on the 20th; lowest, 29.64 inches, at Sioux City and Cedar Rapids, on the 24th.

The month of July was hot and relatively dry. The mean temperature for the State,  $75^{\circ}$ , was about  $1.5^{\circ}$  above the normal. The proportion of sunshine was unusually large; the days were hot, but the nights were relatively cool, serving to mitigate the fervency of temperature.

The average rainfall, 3.33 inches, was slightly below the normal amount. In general it was ample for the crops.



## OBSERVERS NOTES.

*Clinton.*—DR. LUKE ROBERTS: July, 1893, was a very warm month, with an excess of sunshine. In fact it was the warmest July in fifteen years, save that of 1887, which went  $.4^{\circ}$  higher, but whose number of clear days was one less and the per cent of cloudiness eight higher. The excess of heat for this month of 1887 was due to the unusual high maximum. It rose above  $100^{\circ}$  on five different days, four of which were consecutive, from the 14th to the 17th, inclusive. The highest temperature reached in July, 1893, was  $95^{\circ}$ , and there were sixteen days in which the maximum stood at  $90^{\circ}$  or above. The minimum temperature was  $58^{\circ}$ . This high minimum for July was duplicated only once previously during the last fifteen years. This was in 1888.

The peculiarity of July, 1893, was its unusual uniformity of temperature, and absence of sultry, breathless nights. There was no night uncomfortable for sleeping.

*Bonaparte.*—B. R. VALE: An ideal harvest and crop growing month combined. A little dry at end of month.

*Cedar Rapids.*—H. D. OLDS: The month has been remarkable for almost continuous clear weather, but one day that could be classed as cloudy and three days as partly cloudy. The mean temperature of the month has been about  $1.5^{\circ}$  above the average for the past ten years at this station. Highest mean,  $77.8^{\circ}$  in 1887, and lowest,  $70.4^{\circ}$  in 1891.

The rainfall has been the lowest with one exception (1886) when precipitation for July was only .57 of an inch. Greatest amount, 6.48 in 1885.

*College Springs.*—A. A. BERRY: A splendid month for the farmer. Corn never was a fairer prospect to excel in the greatest yield. The last half of month a little too wet for grain in shock.

*Fort Dodge.*—R. W. BLAIN: In July there were twenty-six clear days, three cloudy and two partly cloudy. Rainfall, 3.82 inches. Four rainstorms were accompanied by lightning and thunder.

## THE POMEROY TORNADO.

The most notable meteorological event of the month was the great wind storm, which occurred on the evening of July 6th, and is generally described as the Pomeroy tornado. The storm originated near the center of the southern half of Cherokee county, and moved on a general line about 15 degrees south of east, a distance of nearly 56 miles. After leaving Cherokee the storm swept through the southern townships of Buena Vista county, across the southwest corner of Pocahontas county, and thence two-thirds of the distance through Calhoun county, crowning its career of devastation by destroying the larger part of the residence portion of the thriving town of Pomeroy. This tornado caused greater destruction of life than any storm that ever visited Iowa, and in respect to destruction of property it ranks second only to the noted Grinnell tornado of June 17, 1882.

Judging by the debris and other visible effects at Pomeroy, and the descriptions of observers at other points, the storm bore all the characteristics of a tornado. The width of its path was variable, ranging from 800 to 1,800 feet. A number of intelligent observers distinctly saw the whirling and writhing pendant, which they variously describe as funnel-shaped, like an elephant's trunk, etc. Others, who were very near the path of the

storm, saw only a great mass of densely black or greenish vapor rolling over the ground like a swirl of Missouri river waters, accompanied by electric flashes and an indescribable roar or humming sound, unlike any noise ever heard before. The scene was quite different at various points of observation, the mass of clouds alternately lifting and falling, changing form continuously as it advanced. One observer says he saw two huge masses of white clouds approaching, one from the southwest and the other from the northwest; between them was a mass of inky, black vapor, from which trailed four elongated trunks that swayed and twisted and bounded up and down as they swung along, and only one touched the ground in passing his place. Making due allowance for an excited imagination, there is doubtless a measure of truth in the many seemingly conflicting reports as to the appearance and behavior of the storm. They all attest the fact that it was a genuine "twister" of the most virulent type.

Through the first half of its journey the storm lifted at frequent intervals, bounding and swaying slightly north and south of its general path; but after passing Storm Lake it gathered new force and kept more continuously to its work of destruction, making a line nearly as direct as the flight of an arrow toward the fated town of Pomeroy. On the north side of its path are seen occasional indications of lateral currents, some of which left wreckage in their course, giving apparent ground for the statement that the main storm pursued a zigzag pathway.

#### TIME SCHEDULE.

According to the various reports as to the hour of the evening when the tornado passed the different points on the line of its travel, its progressive movement eastward was quite slow. It began its work in Cherokee county at about 5:00 P. M. Observer Hadden states that it passed south of Alta at 5:20. Observer Bond, of Storm Lake, reports it as having passed by that place at 5:30. Postmaster Blair, of Newell, gives the hour of its appearance at a point about a mile south of that place at 6:00. And all accounts agree that it struck the town of Pomeroy between 6:30 and 7:00 P. M. The *Herald* of that place states that it was just 7 o'clock when the storm began its work. The writer saw a pendulum clock among the debris which had been stopped at 6:40. So making due allowance for the variation in time pieces, the storm must have occupied an hour and forty minutes in traveling fifty miles, making about the usual speed of an express train. Evidently the tornado could have been handled or scheduled quite easily by a good train dispatcher, and people in the towns along its line could have been warned to side-track before it reached their stations. In this there is at least a suggestion of the possibility of establishing a system of warning whereby lives may be saved. Though the storm traveled quite slowly eastward, its whirling and uplifting movements must have been inconceivably rapid, and there is no evidence that it was wasting any time on its way.

#### SOME NOTEWORTHY POINTS.

The fact has been stated that the general direction of the tornado was a little south of east. The first twenty miles of its course was almost due east, and if it had held steadily to that line it would have struck the thriving and handsome city of Storm Lake. But on approaching the northwestern point of the lake it deflected slightly southward, that body of water evidently

offering the line of least resistance. After reaching the more level region beyond the outlet of the lake, its path was very nearly on a direct air line, about parallel with the Illinois Central track.

The weather records show that fully 80 per cent of tornadoes move from southwest to northeast. It is a noteworthy fact, however, that the three longest and most destructive storms of that character that have visited Iowa, viz., the Comanche tornado of 1860, the Grinnell tornado of 1882, and the late Pomeroy storm, all moved along a line trending toward the southeast. There appears to be something more than coincidence in the fact that these three major storms have pursued the same general course, apart from the line of general disturbances. The suggestion may be offered that the more powerful northwest currents not only give direction, but also add to the intensity of the whirling columns.

Another point may be noted here. Intelligent residents at Pomeroy, who took note of the approach of the storm from the west, state it appeared to have originated at that place. The Pomeroy *Herald* says:

"The sky was a fearful sight to behold, clouds of inky blackness filling the entire west, rolling and surging in wild commotion. One cloud came from the northwest and joined a second from the southwest, then whirled and sucked its resistless passage toward the fated town. The air was filled with flying debris and the roar of the storm was above all."

Observers at the various stations along the line relate that they saw two clouds approach each other, and then the work of destruction began. At every point of observation it looked as if the meeting of the clouds of vapor—visible air currents—caused the disturbance. Evidently they were lateral currents drawn into the central vortex, possibly serving as feeders of the devastating monster. In nearly all descriptions of tornadoes in the papers, and by local observers, we note the same account of clouds meeting clouds. In a study of this class of storms this fact is deserving of consideration.

#### REPORT BY DAVID E. HADDEN, OF ALTA.

From the very full detailed report by Prof. David E. Hadden, of Alta Buena Vista county, we make the following extracts:

On July 5th, the day preceding the tornado, the wind blew briskly from the southeast all day, with increasing cloudiness and a moderately heavy thunder-storm towards evening. The sky had a very threatening appearance, heavy dark clouds and very vivid lightning. The morning of the 6th opened with a light east wind, partly cloudy sky which gradually increased, the wind bearing to southward and almost calm. The morning was "close" and murky, and the sultriness greatly increased, becoming very oppressive during the afternoon. At about 4:00 P. M. the sky assumed a stormy appearance, "thunderheads" appeared in the west and northwest. At 4:20 P. M. thunder was first heard in the northwest, proceeding from a bank of dark clouds. Soon the lightning became "forked," and several sharp peals of thunder quickly followed the rapidly advancing portion of the thunder cloud. About this time the lightning in the northwest was continuous and the thunder incessant, a peculiar rumbling roar continued, which was unlike any noise produced by even distant thunder; this continued until about 5:00 P. M. The dark bank of clouds in the northwest seemed to have traveled northeastward. At 5:00 P. M. a very large, heavy, dark mass of clouds was seen almost due west and apparently at a distance of about three or four miles.

Much sharp lightning and thunder accompanied it. As it advanced it was seen to be in violent commotion, a strong ascending current appearing in its midst. It traveled in a southeast direction. About 5:15 P. M. a heavy, rapidly moving cloud was seen to move from a southeast to northwest direction, meeting the advancing storm; it suddenly dipped and raised, then dipped and raised again and traveled eastward, south of Alta, at a distance of about two to three miles. At the same time intensely sharp lightning and deafening thunder peals passed over the town, traveling in an east and northeast direction. This continued until 5:30 P. M. At 5:15 or 5:20 P. M. the wind suddenly blew hard from the northeast for about ten minutes when it gradually decreased and veered to north, then west, then variable. At 5:30 P. M. very large hail, in some cases several inches in diameter, very angular and honey-combed, came from the north, breaking hundreds of windows, limbs of trees, etc. At 5:35 P. M. the hail ceased; the ground was covered almost white, and were it not for the light wind then prevailing, the damage by this source would have been much more serious. Heavy rain commenced falling at 5:30 P. M. and ceased at 5:40 P. M.; amount, .28 inch. Immediately after the storm passed, the east and southeast sky was of an inky blackness. Swiftly moving, large masses of dark clouds at a low elevation were observed to come from the northwest toward the storm region. After this the sky partly cleared, but about 8 P. M. a heavy thunderstorm with very hard rain came up from the southwest and lasted about three hours, accompanied by a high, northwest wind from 10 P. M. to 10:25 P. M.

The tornado entered Buena Vista county about four miles southwest of Alta and passed across the county. The tornado passed through the center of the lake, raising the water to a height of about 100 feet.

The hail was confined almost entirely to the track of the tornado and for about two miles on the north side of the track; but little occurred south.

Mr. J. H. Wadsworth was injured about the face, as if by fire; he thinks he was enveloped in a "stream of electricity;" it seems difficult to account for the character of his injuries otherwise.

Mr. C. W. Garberson, living about eight or nine miles on the north side of the storm track, says that many hundred balls of fire filled his yard, coincident with a blinding flash of lightning which struck a private line telegraph pole near his house.

On the south of the track a brisk wind from the southeast or east preceded the tornado, followed, during its passage east, by a high westerly wind.

A grove on the west side was unharmed, while a fine, large barn a few rods east on Henry Tutt's farm was completely demolished.

Chickens were found alive and completely stripped of all feathers.

Near the Hetrick farm the fence running north and south was plastered with mud on the northwest side of the posts to a depth of many inches.

Large trees over a foot in diameter were twisted in all conceivable forms as if they were mere twigs.

The direction of the funnel cloud was from south to west by the east. In some places debris was so scattered as to indicate a straight blow, while in others the "twister" was plainly seen.

In some instances an expansive force was evident, the sides being blown outward in all directions; in others the "uplift" was tremendous.

The sky became exceedingly dark just before the storm struck.

Charles Anderson, on the Joseph Boulting farm, found one of his horses lodged in a tree, while its mate was carried clean over the grove and deposited in a field.

A reaper wheel of solid iron was carried from the Slate place and dropped in the field, half a mile away. A board was forced edgeways half through a tree, and so firmly imbedded that it could not be broken off.

The following persons residing in this county were killed or have since died:

B. Johanneson, aged about twenty years.  
Chas. Totman, aged about fifty years.  
W. R. Clemons, aged seventy-eight years.  
Jacob Breecher.  
Jacob Breecher's daughter, aged five years.  
Joseph Slade, aged about sixty years.

Estimated losses in Buena Vista county, extract from Storm Lake Tribune:

W. L. Chamberlain, house, outbuildings, corn, orchard and trees.....	\$ 1,500
Wm. Clemons, house, furniture and clothing . . . . .	1,400
L. A. Clemons, house, barn, tools, orchard and trees. ....	2,500
Charles Totman, house, furniture, clothing, stock, machinery, crops, etc.....	1,448
Thos. Wall, machinery, stock, crops, clothing.....	796
Donald Hill, barns, cribs, machinery .....	800
C. Hetrick, house, barn and wind-mill.. ....	1,300
Jacob Breecher, house, barn, granary, machinery, crops, stock, clothing, etc....	3,500
S. J. Powell, house, barn, sheds and crops.....	1,500
J. Whitmore, machinery, furniture, clothing . . . . .	800
Sam Coulson, corn... . . . .	60
G. L. Watson, house and barn.....	1,000
Henry Tutt, barn, granary .....	800
Henry Fisher, barn, steamboat.....	1,000
Albert Scharn, machinery, stock, crops, furniture, clothing.....	1,066
Patrick Kennedy, two horses and barn.....	150
Total .. . . .	\$19,610

There were three other losses not included in the above, that of the Lake Side farm, estimated at \$5,000, at V. A. Bryant's \$1,000, and at Frank Snyder's about \$500.

#### REPORT BY A. J. BOND, STORM LAKE.

Observer A. J. Bond, of Storm Lake, sent notes and newspaper clippings, from which the following extracts are made:

The time of beginning was about 5:20 P. M.; time of passing nearly ten minutes; direction S. E. E. Breadth of track 20 to 40 rods. The bounds of its track are well defined on ridges, but the storm did not make a clean sweep, and many fields of grain in the track are left standing, apparently uninjured. The storm evidently passed most easily over the valleys, and was apparently turned from its course by high ridges or strong buildings surrounded by dense groves, as at Lake Side and beyond. At the Lake Side farm it whirled through an opening where are the cattle-yard, sheds, and cribs, which were demolished, but left the strong buildings, and was borne over the dense grove beyond, taking the tops of the scattering tall trees only. So storm Lake may have escaped, the lake surface being taken as a course of less resistance. The tornado did not hug the ground closely,

but there are many places both west and east of the lake where the effects of the irresistible whirlwind are evident, and the currents were strong enough to lift and carry away light buildings, particularly such as stood in the openings or on the edge of a heavy grove, around which the storm curved in great violence. In several places the groves seem to have borne up the storm and carried it over by their density and elasticity, and they are now standing green and unscathed, while scattering trees are destroyed. The storm as it passed over the lake is described as a rolling cloud of dense blackness.

The trailing appendages, which news reporters have pictured, were not observed here, and I am of the opinion that there may be tornadoes without them: And if in future I see a black cloud approach against the wind, with roaring and thunder, followed by a moment of calm, I shall be apt to drop into a hole, or flee to a cellar, and not wait to look for a tail.

As the storm approached all low clouds, east and north, seemed driven rapidly toward the point of loudest thunder. The thunder was heard first in the northwest, then as the storm cloud passed in the southeast, and last very distant in the east. At about 5:30 observer went indoors, listened to the thunder and roaring, noted the hail and rain, and the changes of wind from brisk east to calm, then quickly to strong, gusty southwest, west and northwest, and back to light east. But we did not know there was a tornado till later.

The scorched appearance of trees, attributed by one writer to electricity, I observed carefully on some maple standing in a fence row. The trees were not broken, but twisted and bent so as to loosen the outer bark, which had been taken off by the wind and carried away, the inner bark left presenting a yellowish brown, which is its natural color, while the leaves of the trees were whipped and torn to shreds and dried, the stems still adhering to the tough, unbroken twigs and the whole tree, body and top, presenting the appearance at a distance of having been singed, though on close inspection it was evident that nothing of the kind had happened. Many other trees which had received a sand-blast from the lake beach, presented a similar appearance.

At Lake Side farm the tornado encountered the hill, grove and buildings, and was turned from its course to nearly southeast, passing the east lake bluff through the valley of the lake "outlet." In crossing this bluff ridge the whirlwind seems to have been raised and passed over the corn fields on the east side, doing little damage, but only moved one barn, which stood on a high point, and trimmed some trees on another ridge.

In many places along the line the storm seems to have changed its course to avoid obstacles for other lines of less resistance, and then to have returned to its general direction. And I would suggest that a survey might be made of the whole track for the purpose of determining the safest locations for buildings in general, and what artificial safeguards may be placed around them and used in their construction.

If a tornado can be lifted up and passed safely over a farm house by a proper arrangement of groves, it would be well for the public to know it.

No doubt there are many ways of protecting our buildings from the devastating tornado, which we may learn only by carefully observing and respecting and acting upon God's laws as shown in natural phenomena.



The Storm Lake *Pilot* says:

The storm as viewed at Storm Lake was about forty rods wide and almost black darkness enveloped its path, while a few miles south and north the sun was shining. James DeLand sat in his buggy in the sun four miles south and watched the cloud pass between him and the city. F. M. Curtis reports that he stood near Fisher's Casino and watched the cloud until it reached the Chamberlain place, and then hastened to the cellar, the death-dealing tornado passing a few rods north. The storm began near Quimby, in Cherokee county, and its course was east by a little southeast. There several people were killed. It entered Buena Vista county on the line between Nokomis and Maple Valley townships, but did no extensive damage until it reached the farm of Geo. Baker, Sec. 33, Nokomis; here it swept away his barn and killed some stock.

#### OTHER REPORTS.

Postmaster Blair, of Newell, writes that the storm passed about one mile south of that place at 6 P. M., destroying buildings, groves and crops in its path, injuring several people.

W. L. Thompson, of Manson, writes that the storm began in the southwestern part of Cherokee county and ended about four miles west of Manson, in Calhoun county (about four miles east of Pomeroy). The day was clear and sultry, no air stirring, the mercury at 2 P. M. at 90°. About 4 P. M. heavy clouds showed up in the west and northwest. The dark bank was preceded by scud clouds. As the cloud bank advanced the center of it, northwest of Manson, and about on a line with Pomeroy, took on a green color. The tornado struck that place at 7 P. M., and spent its force there in three to five minutes. A light rain preceded it about five minutes.

It seemed to strike the earth, slantingly from above, crushing everything beneath it, then rising with a whirl, scattering the wreckage in all directions, one part of a house being blown to the south and another part west. The direction of the wind all day had been from the southeast. Violent thunder and lightning accompanied and followed the tornado, while two miles east it looked like a straight blow. The death roll at Pomeroy and immediate vicinity was 48 (on the 10th inst.) and the wounded in hospital or under care of surgeons, numbered 75. The area of total destruction in Pomeroy is about one mile east and west, and from one-fourth to one mile wide.

Observer H. B. Strever, of Larrabee, reports that the tornado formed three miles west of the center of the southern half of Cherokee county, or about the center of the southern tier of sections in Rock township. It is probable, however, that the storm was not fully developed until it reached Pilot township, where its destructive effects were first noted.

#### THE SCENE AT POMEROY.

The Director visited the stricken town on the day following the disaster, and again on the 14th, accompanied on the latter date by Dr. Geo. M. Chappel, Local Forecast Official of the United States Weather Bureau, and Assistant Director of the Iowa service. A careful inspection was made of the debris and other visible effects, to determine, so far as possible, the nature and special characteristics of the storm which wrought such appalling destruction in so short a space of time.

The town plat contains about thirty blocks south of the Illinois Central Railway. The business houses are mainly located between First and Second streets, nearly all the private residences, together with the churches and

school house, being south of Second street. Eighty per cent of the residences were destroyed or rendered uninhabitable. Fully twenty blocks were swept clean of human habitation or other buildings, nothing remaining but the debris, and a few mounds above the caves wherein many lives were saved.

The blocks of the town are about 300 feet wide, and the streets the usual width. From this it will be seen that the average width of the belt of complete destruction is about 1,200 feet; and the track of total and partial destruction is 1,800 feet.

The school house was unroofed; the sides were blown outward and the upper floor was broken on either side of the central partition, the bulk of the wreckage being carried towards the south. The west tower was demolished and the steel bell weighing 200 to 300 pounds, was carried a distance of two blocks to the northwest.

On the left of the central track (north side) all the wreckage of buildings sidewalks, trees, etc., were carried to the southwest. At the northwestern point, where the storm first struck the town, a residence was pushed bodily six rods to the southwest, over trees and shrubbery, scraping the sod as it went, forming a bank of earth on its south side three feet high. A little over a block south of it stood the German Lutheran church the largest and strongest structure in the town. That was blown in pieces, and most of the debris was carried towards the northeast. At the extreme east of the town plat, near Third street, stood the Catholic church. An intelligent resident states that he saw that building lifted up bodily in the air, whirled around and then dashed to the earth. The wreckage is strewn towards the southwest. A little south and east of that building stood another smaller church, which was wrecked and blown towards the northwest. On the extreme south side of the path of the storm houses were moved and loose debris carried towards the northeast. In the central belt the smaller debris, and in fact all forms of wreckage, were found on the direct line of the storm. This fact led some reporters to the conclusion that the greater work of destruction was done by a straight blow from the northwest. There was quite likely a straight wind of hurricane force following directly in the wake of the revolving shaft of destruction, and that wind undoubtedly had a part in the distribution and direction of the debris. On the flanks, however, the same degree of uniformity is not visible.

The trees on the flanks, and the few gnarled and twisted trunks of trees and shrubbery left in the center of the track, all bore mute testimony as to the character of the storm. On the left they were partially denuded of bark on the north or northeast sides, and the broken or uprooted trees pointed to southwest. On the right flank reverse effects were seen. And in the central portion of the track the stubs and trunks were almost wholly divested of bark, and bore the scars of contact with a great variety of flying missiles from all sides. In many cases the bark must have been ground off by attrition, the stubs being too heavy to have been peeled by twisting. By the same attrition fowls were divested of their feathers, numbers of which were seen in the debris. The human victims of the tornado's fury, the dead and wounded, bore evidence on their persons of the fact that the air was filled with an infinite number of swiftly moving splinters, sand, mud, plaster, imbs of trees and other movable objects. In fact, some of them were literally tattooed.



The business part of the town was not left unscathed. The brick drug store of Mr. Mullen, near Second street, fronting east, was badly wrecked. The glass front was broken in by the strong current from the northeast, and the entire south wall, a foot thick, was blown over to the southward. Another brick store in the next block east was also demolished.

The value of caves was well attested by this storm. Seven or eight of these places of refuge in the devastated district sheltered forty to fifty people, protecting them from all harm. They are cheap and frail looking for the most part, built necessarily mainly above the ground on account of the damp and undrained nature of the sub-soil, covered with mounds of earth rising four to six feet above the surface; and yet they admirably served their purpose as tornado-proof structures. If every family had been provided with such a place of refuge, and had heeded nature's danger signals, no fatalities would have been recorded. Their cost is trifling and at such a time a very poor hole in the ground is worth more to a family than the richest gold mine in America.

The cellars of Pomeroy afforded a measurable degree of protection to those who made timely flights thereto. We made diligent inquiry, but heard of no well verified instance of fatal injury to people who took refuge in their cellars, but many were bruised by falling debris, or pierced by flying splinters, and few came out of the cellars wholly unscathed. Observing the amount of stones, brick, wreckage of furniture and other debris piled in the cellars, it seems a miracle that any person came out alive. Near the center of the track we were shown a cellar eight by twelve feet wherein a woman and two children were saved from serious harm, and yet while they were crouched near the door at the west wall, a stallion weighing 1,600 pounds was blown in from the east side and remained floundering in its death struggle until the storm had passed and the people were rescued. Columns could be fill with narrations of miraculous escapes, and other columns with the sad details of death and suffering.

The death roll at Pomeroy and immediate vicinity amounted to forty-six, according to our latest verified report. The fatalities along the entire line of the storm number over seventy. In this respect it was the most destructive storm that ever visited Iowa.

#### NOTES AND OBSERVATIONS.

Indications of the uplifting force of the tornado have been noted at all points. It has been stated that in passing over Storm Lake it lifted a column of water 100 feet high. This must be taken with a grain of allowance, for no one was near enough to its track to discern the column through the mass of vapor accompanying the storm. But the fact is well attested by reliable eye witnesses, that while the storm was crossing the lake the waters at the north shore receded rapidly, a hundred feet or more, leaving bare ground at the pier where the small steamboat lands. After its passage the waters rushed back with a tidal wave several feet high.

A great number of intelligent people, who were near the path of the storm, testify to the fact that light structures were lifted many feet, whirled around in the air and then dashed to the earth. In some cases they saw or thought they saw, buildings whirled over and over, somersault fashion, as if the revolving column had for the moment whirled on a horizontal axis.

Near the center of the track in Pomeroy a number of buildings evidently exploded outward, from the force of the expanding air within, the roofs being carried away, and the sides and ends of the structures were left lying as they fell, toward the four points of compass. On the north of the track, in the area of partial destruction, the buildings bore striking evidence of the expansive outrush of air toward the south. Parts of roofs were carried in that direction, and windows were broken from the force within, the glass being carried outside. Numerous houses were seen partially wrecked, their southern sides or wings being blown toward the track of the tornado. There seems to be no room for doubt that the main destructive force in this storm was its tremendous uplifting power.

As to the roaring sound of the storm there is abundant testimony. One man whose family were saved in a cave, remarked as he urged them to flee, that it was either a very bad storm or a very heavy train of cars coming. It proved to be the former.

Postmaster Mallory, of the town of Jolley, five miles south of Pomeroy, writes that the loud roaring noise was distinctly heard at his place. In his description Mr. Mallory says the advance part of the cloud, as it approached Pomeroy, was rolling over and over, parallel with the ground. This was closely followed by two funnel-shaped masses swiftly revolving, the clouds from the southeast being drawn toward the center. The lightning and thunder were unusually violent.

The total property loss occasioned by this storm has been variously estimated, in some cases with great exaggeration. In the town of Pomeroy something over one hundred residences were destroyed or badly wrecked. Some of these were quite valuable, but the majority of homes destroyed were worth from \$600 to \$800 each. The average individual loss did not much exceed \$1,000, and it is probable that a thoroughly accurate appraisal would show that the total loss in Pomeroy was about \$175,000. The bulk of the sufferers were comparatively poor people, whose entire savings except their lots were swept away. These cases appealed to the generosity of the prosperous people of Iowa, and we are glad to note that liberal response was made. The total property loss along the entire line of the storm was probably about \$225,000. In the majority of cases the farm losses were partially covered by tornado insurance. About 20 per cent of the buildings destroyed in Pomeroy were insured.

All in all, it was a notable storm, and we hope never to see its like again in our fair State. The writer is indebted to the postmasters at Aurelia, Sac City, Jolley, Newell, Fonda, Storm Lake and Pomeroy for valuable data relating to the storm. Only a portion of the mass of notes in hand could be used in this report.

#### AUGUST.

The mean barometric pressure was 30 inches. Highest observed, 30.32 inches at Clarinda, on the 30th. Lowest, 29.66 inches at Sioux City on the 9th.

The monthly mean temperature was  $69.4^{\circ}$ , which is about  $1.6^{\circ}$  below the normal. The highest temperature reported was  $101^{\circ}$ , at Bonaparte, on the 9th. The lowest was  $30^{\circ}$ , at Elkader, on the 30th. The frost line was reached on three mornings, but no material damage resulted.

On the whole the weather was favorable for the crops, except a general

deficiency of moisture in the last half of the month. At the close of the month the drouth was being seriously felt in nearly all sections, materially shortening the potato crop and late planted corn. The average rainfall for the State was 2.32 inches, which is about 1.25 below the normal amount.

The month was generally exempt from destructive wind storms.

#### EXCESSIVE RAINFALL.

The following heavy rainfalls were reported during the month:

Clarinda (Page county), from 6:00 P. M. of the 14th to 8:00 P. M. of the 15th, 5.60 inches.

Corning (Adams county), 2.75 inches in 24 hours on the 14th and 15th.

Murray (Clarke county), 3.65 inches in 24 hours on the 14th and 15th.

Villisca (Montgomery county), 3.87 inches on 14th and 15th.

At Sioux City, on 23d, 2.08 inches fell in 50 minutes, causing some local damage.

#### OBSERVERS' NOTES.

*Muscatine*—J. P. WALTON: This has been the driest August for twenty years, and the driest on record with but two exceptions. The rainfall was 1.02 inches; the highest temperature was 95° and the lowest 41°. The mean was 69.8°—a little cooler than the average. There were but two rainy days, and one cloudy day. Corn, potatoes and pastures have been greatly damaged.

#### SEPTEMBER.

The mean atmospheric pressure was 29.94 inches. Highest observed, 30.88 inches, at Dubuque, on the 28th; lowest, 29.48 inches, at Omaha, Neb., on the 30th.

September was warm and dry, the severe damaging drought of the summer extending till near the close of the month. The mean temperature for the State, as shown by the records of seventy-two stations, was 64.7°, which is about 2.7° above the normal. The highest temperature of the season was recorded at the Central Station on the 6th, and at other stations on the 7th. The maximum temperature, 102°, occurred at Glenwood, on the 8th.

The average precipitation shown by records of seventy-seven stations, 2.34 inches, was about 1.36 inches below the normal for September. The bulk of this rainfall came on the last three days of the month. During the first half of the month only a trace of rain was noted in any part of the State.

The distribution of rain was very unequal, the larger part of the State receiving one to two inches.

All crops were ripened and placed beyond danger before the occurrence of the first killing frost, on the 25th.

#### OBSERVERS' NOTES.

*Clinton*.—DR. LUKE ROBERTS: The general meteorological conditions of September, 1893, compare favorably with its predecessors during the last fifteen years. The maximum temperature was 93 degrees, which is 5.1 degrees above a September average for the last twelve years. The minimum temperature was 31 degrees, or 3.1 degrees below normal. The mean temperature was 63 degrees, or 1.7 degrees above average for the past fifteen Septembers.

The first eighteen days of the month were destitute of rain. No rain fell from the 16th of August to the 18th of September. A severe and damaging drought resulted, which prematurely ripened corn, seriously damaged the potato crop and rendered most pastures useless so that stock had to be fed from the winter's store. The Mississippi river came within a few inches of low water mark. On the 18th the drouth was partially broken by a modest shower, which was followed on the 20th by a little more, and on the 21st a copious rainfall gladdened all nature. The precipitation amounted to 1.54 inches—was warm, and accompanied with thunder and lightning. The 22d and 24th furnished a little rain, and on the 29th a copious precipitation occurred, the storm extending over to the 30th, with a total fall of 2.18 inches of water. The total precipitation for the month was 4.25 inches. Although the rainfall all came in the latter part of the month the amount exceeded a September average by 1.21 inches.

During the fore part of the month the movement of the wind was very light, but at the close of the month had nearly made up a September average. Total movement, 2,960 miles. Maximum velocity, 20 miles an hour. Prevailing direction, northeast.

On the morning of the 25th the first frost of the season made its appearance; on the 26th a heavy or killing frost, the temperature of the air going one degree below freezing; on the 27th was another lighter frost.

On the evening of the 1st a brilliant meteor was observed. On the evening of the 30th the temperature began to rise.

*College Springs.*—A. A. BERRY: First half of the month very dry and pastures suffered. Fall wheat acreage will hardly be up to the average. As good a crop of corn as Page county ever had.

*Belle Plaine.*—H. W. VANDIKE: The drouth of this month has been unprecedented. No rain to wet the ground from August 15th to September 29th.

*Cedar Rapids.*—H. D. OLDS: The month has been almost without rain; but .06 of an inch of rain fell between August 23d and September 29th. Pastures suffered severely and the ground was too dry for plowing.

*Bonaparte.*—B. R. VALE: With only 2.40 inches of rain in July and 2.02 in August, and no rain from August 15th to September 20th, it was the most intensely dry period we ever had. The soil drank up the rain (5 inches) but it did not start the streams.

*Williams.*—MERTON L. FULLER: The drought which began August 24th, continued, with the exception of a single fog or mist, for twenty-five consecutive days—the longest absolute dry spell in seven years.

*Richland.*—W. A. SHAFFER: Ice formed one-fourth of an inch thick on the 24th. The severest storm of the season on the 21st, accompanied by loud thunder, high wind, and hail three-fourths of an inch in diameter.

#### OCTOBER.

The mean barometric pressure for the State was 29.99 inches. Highest observed, 30.60 inches, at Clarinda and Des Moines, on the 29th; lowest, 29.22 inches, at Dubuque, on the 6th.

The month of October was warm and dry.

The mean temperature was 52.4°, which is about 3° above the normal of the State. There was less than the average amount of cloudiness, the rec-

ords at the Central Station showing 254 hours of sunshine, or 74 per cent of the number of hours of possible sunshine during the month.

The average amount of precipitation was 1.28 inches, which is less than half the normal amount for the State. The distribution was quite unequal, the range being from .02 of an inch at Algona, to 4.56 inches at Blakeville.

#### OBSERVERS' NOTES.

*Alla.*—DAVID E. HADDEN: A very dry month. Wells throughout the country are very low.

*Bonaparte.*—HON. B. R. VALE: A very seasonable month; the last half has been improved in cribbing corn.

*Murray.*—A. W. LEWIS: On the evening of the 26th, at 8:55, a very bright meteor appeared in the northwest, which exploded when about  $40^{\circ}$  above earth. It was bright enough to throw a shadow against the rays of a very bright full moon. When the explosion occurred it had the appearance of a very large rocket.

*Clinton.*—DR. LUKE ROBERTS: October, 1898, was a fine month. In temperature was  $2.1^{\circ}$  above normal. The number of clear days was 15, cloudy days only 8, and fair days 13. The number of storm days was but 4, and these furnished only .68 of an inch of rainfall, while a normal rainfall for October is 2.67 inches. As a rule October is not a stormy month. The greatest precipitation for October for the last fifteen years was 5.55 inches. This was in 1881.

The maximum temperature was normal, while the minimum temperature was five degrees below normal. The warmest day was  $2.4^{\circ}$  above normal and the coldest day  $4.9^{\circ}$  below normal. The warmest day was the 1st and the coldest the 29th. The principal meteorological conditions for October may be epitomized as follows:

Highest temperature,  $82^{\circ}$ ; lowest temperature,  $18^{\circ}$ ; extreme range,  $64^{\circ}$ ; mean temperature of warmest day,  $70.5^{\circ}$ ; mean temperature of the coldest day,  $27.2^{\circ}$ ; mean temperature,  $51.2^{\circ}$ ; number of stormy days, 4; total precipitation, .68 inches; number of clear days, 15; number of cloudy days, 8; per cent of cloudiness, 82.

#### NOVEMBER.

**BAROMETER.** Mean pressure for the month, 30.08 inches; highest observed, 30.55 inches at Clarinda, on the 30th; lowest observed, 29.88 inches at Cedar Rapids, on the 21st. Range for the State, 1.17 inches.

The mean temperature of the month,  $34^{\circ}$ , was about the normal for the State. The first half of the month was above, and the last half below the normal.

The average precipitation, as shown by records of seventy-three stations, was 1.17 inches, which is about .50 of an inch below the normal amount. The first and second decades were unseasonably dry, the bulk of the precipitation falling in the last decade. The first general snow storm occurred on the 30th. The ground was unusually dry at the close of the month, and the water supply was very scant in the larger part of the State.

#### OBSERVER'S NOTES.

*Belle Plaine.*—H. W. VANDIKE: Owing to the prolonged drought water will be scarce for stock outside of the artesian belt.

*College Springs.*—A. A. BERRY: A splendid month for gathering corn.

A good turn-out, and plenty of rough feed. Month closed stormy and wintry.

*Clinton.*—DR. LUKE ROBERTS: November was a fine month. The mean temperature was  $6.4^{\circ}$  above normal; minimum,  $8.8^{\circ}$  below; mean,  $1.2^{\circ}$  below normal.

The warmest day was the 1st, the mean temperature being  $61^{\circ}$ ; coldest day the 29th, the mean temperature being  $27.2^{\circ}$ . There were 8 stormy days, 8 cloudy and 15 clear. Per cent of cloudiness, 32. Prevailing direction of wind, west; maximum velocity, 26 miles an hour; total movement, 4,260 miles—22 below normal.

#### DECEMBER.

**BAROMETER.** Mean pressure for the month, 30.14 inches; highest observed, 30.88 inches, at Dubuque, on the 18th; lowest observed, 29.58 inches, at Des Moines, on the 15th. Range for the month, 1.35 inches.

The daily mean temperature for December was  $22^{\circ}$ , which was about  $1.5^{\circ}$  below the normal for the State. The first half of the month was unusually cold, and the last half warmer than the average for December weather.

At the central station precipitation fell on 22 days of the month. The average amount for the State, 1.31 inches, was about 0.34 inches below the normal. During a considerable portion of the month the larger part of the State was covered with snow of sufficient depth to make good sleighing. At the close of the month the ground was generally bare.

#### OBSERVERS' NOTES.

*Cedar Rapids.*—H. D. OLDS: Snow all gone on open ground and but little remaining in the timber. The mean temperature for the month of December since 1884 is  $26.6^{\circ}$ . The warmest that of 1889, being  $38.4^{\circ}$ . The coldest, 1886, with a mean of  $16.5^{\circ}$ . Precipitation about normal.

*College Springs.*—A. A. BERRY. Last half of month very mild. Ground very dry. Fall wheat doing well. Not much frost in the ground. Not much hay fed yet. A light thunder-storm on the 24th.

*Hopeville.*—MILTON T. ASHLEY: Bright rainbow on the 24th, remarkable for duration; was generally noticed and spoken of by many. Mean temperature for that day,  $53.5^{\circ}$ . Very little frost in the ground.

*Williams.*—MERTON L. FULLER: Rain from a cloudless sky. A light shower accompanied a change of wind from southwest to northwest at 9:00 P. M. of the 4th. The raindrops varied much in size, many being quite large. No clouds were visible to the windward of station nor in the central sky—only a thin veil of haze, through which the stars were plainly visible. Similar conditions, though less marked, prevailed at the commencement of the storm on the 8th. Ground has been bare since the 22nd.

*Clinton.*—DR. LUKE ROBERTS: There were no marked conditions to bring December into more prominent notice than December generally furnishes. The first decade was cold, but the balance of the month was moderate. Physical comforts prevailed during this period, which, with the hard times and high price of fuel, was a great boon to the poor people.



## METEOROLOGICAL SUMMARY FOR 1893.

BY LUKE ROBERTS, M. D., CLINTON, IOWA.

Compared with the fourteen preceding years, the year 1893 shows a mean daily temperature of  $2^{\circ}$  below normal. Of the fifteen years five have given a mean temperature below that of 1893, viz:—1883, 1884, 1885, 1886, 1888; the year 1881 was the same as 1893, and the rest of the fifteen years the yearly means were above. The lowest yearly mean in the fifteen years was in 1885, when it was only  $43.9^{\circ}$ . The highest yearly mean for the period mentioned was  $48.6^{\circ}$ , in 1890; so that the extreme range was  $4.7^{\circ}$ , for the fifteen years.

The most influential elements of the weather, both on man and vegetation are the temperature, cloudiness, rainfall and wind. During the last twelve months these elements have gone to some extremes, but as a whole, we find at the close of the year that a happy medium has been the normal condition. As a result the year has been satisfactorily prolific in food products, and the general health of the inhabitants of Iowa. This was manifest by the unusual interest taken in the observance of Thanksgiving, with the many kind and practical remembrances of the needy.

### CONSPECTUS.

Highest temperature,  $96^{\circ}$ , August 10th.

Lowest temperature,  $20^{\circ}$  below zero, January 17th.

Extreme range of temperature,  $118^{\circ}$ .

Mean daily temperature,  $46.2^{\circ}$ .

Mean daily range of temperature,  $24.6^{\circ}$ .

Greatest mean monthly range,  $33.1^{\circ}$ , November.

Least mean monthly range,  $19.9^{\circ}$ , March.

Greatest daily range,  $44^{\circ}$ , April 2d, September 17th.

Least daily range,  $5^{\circ}$ , March 22d, November 27th.

Warmest month, July—mean temperature,  $76^{\circ}$ .

Coldest month, January—mean temperature,  $8.1^{\circ}$ .

Warmest day, July 7th— $84.2^{\circ}$ .

Coldest day, February 7th— $10^{\circ}$  below zero.

Total number of days with maximum temperature  $90^{\circ}$  or above, 25—2 in June, 16 in July and 7 in August.

Total number of days with maximum temperature below  $32^{\circ}$ , 62—28 in June, 15 in February, 5 in March, 4 in November and 10 in December.

Total number of days with the minimum temperature  $31^{\circ}$ , 149—31 in January, 28 in February, 23 in March, 8 in April, 1 in May, 1 in September, 7 in October, 23 in November, 27 in December.

Total number of days with the mean temperature below  $32^{\circ}$ , 108—31 in January, 27 in February, 14 in March, 2 in October, 11 in November, 23 in December.

## THE SKY.

Mean daily cloudiness, 42 per cent of surface of sky.

Month with greatest per cent of cloudiness, March—69.

Month with least per cent of cloudiness, August—20.

Total number of clear days, 138.

Total number of cloudy days, 84.

Month with greatest number of clear days, July—18.

Months with least number of clear days, January and December—6 each.

Month with greatest number of cloudy days, April—16.

Months with least number of cloudy days, July and August—1 day each.

## PRECIPITATION.

Total depth of snow fall, 48 inches.

Greatest fall of snow at any one storm, 5 inches—January 11th and February 5th.

Total precipitation, rain (and snow melted) 30.39 inches.

Greatest rainfall at any one storm, 2.08 inches—April 11th.

Month with greatest precipitation, April—5.48 inches.

Month with least precipitation, October—.68 inches.

Month with greatest number of stormy days, April—13.

Month with least number of stormy days, August—2.

Total number of stormy days, 93.

## THE WIND.

Total movement of wind, 51,600 miles.

Maximum velocity per hour, 40 miles—December 18.

Greatest monthly movement, 6,760 miles—April.

Least monthly movement, 2,080 miles—August.

Prevailing direction, west.

Observations taken at 7 A. M., noon, 2 P. M., and 9 P. M., show the movement of the wind to have been from the north, 76 times; from the northeast, 131 times; from the east, 105 times; from the southeast, 115 times; from the south, 119 times; from the southwest, 151 times; from the west, 214 times; and from the northwest, 177 times.

Maximum velocity for January, 27 miles an hour; for February, 26 miles; for March, 26 miles; for April, 32 miles; for May, 23 miles; for June, 32 miles; for July, 36 miles; for August, 20 miles; for September, 20 miles; for October, 26 miles; for November, 26 miles; for December, 40 miles.

## SNOW AND FROST.

The last spring snow fell on the 21st of April—only  $\frac{1}{4}$  inch. The first snow in autumn fell on the 21st of November—2 inches. Last killing frost in the spring, April 17th. Last frost May 3d and 4th. First killing frost in autumn, September 26th; a light frost on the 25th. Number of consecutive days without killing frost, 162; the same as in 1892. The temperature of the air was at the freezing point or below for the last time in the spring on the 6th of May. The first in autumn, September 27th. The last day when the mean daily temperature of the air was below 32° was March 26th. The first in autumn, October 28th.



ELECTRO METEORS.

Number of auroras observed—8. Number of days with thunder and lightning—17. It is notable that there was a minimum amount of thunder and lightning during the year, and none seriously damaging. An unusual limited number of solar and lunar halos observed, as also meteors. Following is a table showing the yearly mean temperature, rainfall and movement of the wind for the years named:

YEARS.	Mean Temp. —degrees.	Rainfall in inches.	Wind move- ment—miles.
1879.....	46.7	34.18	.....
1880.....	47.1	36.18	.....
1881.....	46.2	41.17	.....
1882.....	47.8	41.18	61,460
1883.....	44.0	38.71	63,560
1884.....	45.7	43.40	54,440
1885.....	43.9	38.21	54,490
1886.....	45.6	28.71	49,260
1887.....	47.2	34.01	53,110
1888.....	45.1	35.80	56,295
1889.....	48.1	31.98	49,720
1890.....	48.6	32.62	51,890
1891.....	48.5	33.87	48,625
1892.....	46.4	40.73	43,890
1893.....	46.2	30.39	51,600
Means.....	46.4	36.07	53,195

JUNE CROP REPORT.

ACREAGE AND AVERAGE CONDITION OF CROPS, CONDITION OF LIVE STOCK, ETC.

The crop season of 1898 opened under favorable conditions for plowing and seeding, and during the first half of April an unusual amount of farm work was done, with the soil in excellent tilth. The last half of April and first half of May was unusually cool and wet, retarding all farm operations in the larger part of the State. Since about the middle of May the season has been fairly good, and the time has been well improved. The June reports of the correspondents of this Bureau, relative to the acreage and condition of crops, live stock, etc., give the following results:

WINTER WHEAT. This crop is now raised in small areas in forty-four counties. The reports show an increase of 2½ per cent in the acreage, as compared with last year. The condition of the crop is rated at 87 per cent.

SPRING WHEAT. There is an average reduction of 6 per cent in the acreage of spring wheat, compared with 1892. Its condition is placed at 96 per cent. On the basis of the estimated acreage of last year, the total yield of spring and winter wheat in Iowa will not exceed 7,000,000 bushels.

CORN. The reports of correspondents show an increase in the acreage planted in corn in every county except two. The average increase for the State is 10 per cent, compared with last year. The total acreage is not yet officially estimated from the returns of township assessors, but it will probably not exceed 6,500,000 acres. The condition of the crop is 98 per cent, the stand and color being generally very good.

**OATS.** Seventy-eight counties report an increase in the acreage of oats, and twenty-one report a decrease, compared with last year. The average for the State gives an increase of 5 per cent in the area sown, and the average condition is 96 per cent.

**RYE.** Decrease in acreage, 7 per cent; condition, 93 per cent.

**BARLEY.** Increase, 1 per cent; condition, 95 per cent. This cereal is raised in about three-fourths of the counties of the State, and the total acreage is small.

**FLAX.** There appears to be an average decrease of 12 per cent in the area of this crop, compared with 1892. The condition is 94 per cent.

**TIMOTHY.** An increase of  $1\frac{1}{2}$  per cent is reported in acreage; condition, 98 per cent.

**CLOVER.** The reports show a decrease of  $\frac{1}{4}$  per cent in the area sown in clover this season. The condition is 95 per cent. Clover meadows were generally killed out or injured by the severe winter, which will materially reduce the crop of clover seed this year.

**MILLET.** A decrease of 2 per cent in the acreage of this crop is reported. Condition, 96 per cent.

**BROOM CORN.** This crop is raised in small quantities in about one-fourth of the State. Reports show a decrease of 5 per cent in the acreage planted. Condition, 91 per cent.

**SORGHUM.** Decrease, 3 per cent; condition, 93 per cent.

**IRISH POTATOES.** Increased acreage  $5\frac{1}{2}$  per cent, compared with last year. Condition of crop, 101 per cent.

**SWEET POTATOES.** Acreage same as last year; condition, 95 per cent.

**PASTURES.** 99 per cent, and meadows, 98 per cent. The hay crop will be heavy.

**SPRING PIG CROP.** Reports from nearly every county show a heavy loss of spring pigs from effects of cool weather and other causes. The average is 72 per cent, or a loss of 28 per cent of the crop.

**LIVE STOCK CONDITION.** Cattle, 97; sheep, 97; hogs, 95; horses, 100; foals, 88.

Condition of soil compared with 1892, 129 per cent.

The latest frost reported was June 1, but it was not damaging.

The majority of correspondents report the season from 8 to 10 days early compared with last year.

#### JULY CROP REPORT.

June, 1893, is entitled to rank as an ideal crop month, the weather conditions being well nigh perfect for the cultivation and rapid growth of all crops. The average temperature was slightly above the normal, and there was an abundance of sunshine and rainfall. There was a marked improvement in the condition of corn, hay, oats and most other staples.

The following averages are obtained from correspondents' reports:

Winter wheat, 91; spring wheat, 93; corn, 103; oats, 95; rye, 93; barley, 95; flax, 95; timothy, 95; clover, 92; millet, 96; broom corn, 97; sorghum, 95; Irish potatoes, 103; sweet potatoes, 96; pastures, 101; hay crop, 97; apples, 60; pears, 56; plums, 67; peaches, 74; grapes, 95; blackberries, 86; raspberries, 90; strawberries, 87.

A large number of correspondents state that their estimates of the condition of corn were by comparison with the crop of 1892, which fell consider-

ably below the average. This accounts for the high rating of that crop. The present condition of corn throughout the State, compared with the normal, is undoubtedly about 99 per cent. The outlook for corn is certainly flattering, and if there are no serious drawbacks it is likely to reach 100 per cent, or a full average crop.

#### AUGUST CROP REPORT.

During the month of July there was a rapid advancement in the condition of corn, and on the first of August the reports of the crop correspondents of this Bureau show an average condition of 101 per cent, making comparison with the normal or average of the crop. Since August first the severe drougthy weather somewhat lowered its prospects, but is hoped that recent showers will give promise of a full average yield of corn.

Winter wheat has been harvested and mainly threshed. Its condition was rated at 87 per cent, making it about up to last year, when the average per acre was fourteen bushels. The State has about 235,000 acres of winter wheat, giving a total of 3,290,000 bushels. There was an increase of about 43,000 acres this year as compared with 1892.

Spring wheat is rated at 76 per cent, and threshing returns show that this grain was badly shrunk by frost and blight. The estimated acreage of spring wheat this year is 621,305 acres. The average yield cannot exceed eleven bushels per acre, much of that of light weight. This would give a total of 6,834,355 bushels. This added to winter wheat would make our total wheat product 10,124,355. Later returns from threshers may somewhat change these figures.

Oats have made a bad showing from a fairly promising start. The average condition in the State is 67 per cent. In many sections the output falls below half a crop. In others it comes well up to an average. It is doubtful if it finally turns out to be two-thirds of an average in the State. The area sown this year was probably near 4,000,000 acres. The average per acre is not likely to exceed twenty bushels. This estimate may be changed by later returns, but not materially.

Other crops are rated as follows: Broom corn, 92 per cent; sorghum, 89; rye, 84; barley, 90; flax, 92; buckwheat, 90; potatoes, 80; sweet potatoes, 88; millet, 90; apples, 46; grapes, 96, and pastures, 86.

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### IOWA CROPS AND LIVE STOCK.

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BIENNIAL CENSUS OF CROPS AND LIVE STOCK, MADE BY TOWNSHIP ASSESSORS.  
From Monthly Review, September, 1893.

The law of the Twenty-fourth General Assembly, requiring assessors to make biennial returns of the acreage and yield of staple crops, and the number of live stock, etc., has produced quite satisfactory results, considering the fact that this system of gathering agricultural statistics is new in Iowa.

The returns of the assessors, for the current year, showing the acreage

and yield of crops in 1892, and the number of live stock owned by the farmers of Iowa, in January, 1893, have been carefully tabulated and the footings give us the basis of an approximately correct estimate of the farm products of the present year. We give herewith some of the figures relating to the more important products of the State.

**LAND IN FARMS.** The returns show the number of acres of land in farms to be as follows: Improved, 25,024,117; unimproved, 5,186,377; total, 30,210,494 acres. These figures are evidently correct as to the acreage of farms in this State. The State census in 1885 gave the following figures: Improved land, 20,189,894 acres; unimproved land, 8,058,858 acres. The acreage of land in pastures in 1885 was 5,265,858 acres; acreage in 1893, 7,812,898. These figures include only improved or fenced pastures.

**WHEAT.** The acreage of winter wheat sown in the fall of 1892 (harvested in '93), amounted to 233,553 acres. Spring wheat harvested in 1892, 660,240 acres. There was a decrease of 6 per cent in the acreage of spring wheat this year, compared with 1892. The estimated acreage of wheat (winter and spring) harvested this year is, therefore, 854,189 acres. The census of 1885 returned the acreage of spring wheat (in 1884) at 1,294,722 acres; winter wheat, 56,824 acres, a total of 1,251,546 acres. This shows a notable decline in the acreage of spring wheat, and a moderate increase in the winter.

**CORN.** Making due allowance for a number of towns from which returns were not completed, the land in corn in 1892 was 5,469,946 acres. According to the estimates of the correspondents of this Bureau, there was an average increase this year of 10 per cent, compared with the crop of 1892. The area planted this year was, therefore, 6,016,940 acres. That is believed to be approximately correct. It certainly is not an underestimate. In 1884 Iowa's corn acreage was 6,558,724 acres.

**OATS.** The area in oats in 1892 was 3,997,737 acres. An estimated increase of 5 per cent, compared with last year, would make this season's acreage 4,197,623. The acreage in 1884 was 3,054,127.

**BARLEY.** Acreage of barley last year, 501,081. The estimate for this year is 506,091 acres.

**RYE.** Acreage last year, 117,771. This season's acreage, 109,528.

**BUCKWHEAT.** Last year's acreage, 31,042 acres. No change in estimate this year.

**FLAX.** Last year's acreage, 282,700. Estimated acreage this year, 248,776.

**TIMOTHY SEED.** Acreage last year, 164,104, with an average yield of 4½ bushels per acre. No change in estimate for the present season.

**CLOVER SEED.** Acreage, 54,538; yield 1½ bushels per acre.

**IRISH POTATOES.** Number of acres reported last year, 109,733. Estimate this year, 104,261 acres. This does not include the small patches raised in gardens, which would make a considerable showing in the aggregate yield.

**TIMOTHY.** The timothy cut in 1892 was 2,453,015 acres. Acreage about the same this year.

**CLOVER.** The clover cut last year was 258,373 acres; average yield 1½ tons per acre.

**PRAIRIE HAY.** Cut last year, 1,999,403 acres; average 1½ tons per acre.

**MISCELLANEOUS.** Millet, 176,800 acres. Hungarian grass, 9,971 acres. Artificial groves, 178,947 acres. Orchards, 111,488 acres. Vineyards 3,691 acres.

**HORSES.** Number of horses January—Common or grade, 1,281,544; thoroughbreds, 5,269; total, 1,286,813. Number of mules, 32,015.

**CATTLE.** Common or grade, 3,399,810; thoroughbreds, 21,573; total, 3,421,383.

**SWINE.** Number in January, 3,443,118.

**SHEEP.** Common or grade, 561,356; thoroughbreds, 7,065; total, 568,421.

**STANDS OF BEES.** Native, 126,403; Italian, 37,664; total, 164,067. Pounds of honey produced last year, 2,142,555.

## DECEMBER CROP REPORT.

### ROUND-UP REPORT OF THE SEASON, SHOWING AVERAGE YIELD PER ACRE AND MARKET PRICES.

The round-up of the season shows, that, while the total products of the soil in Iowa fall somewhat below an average, yet the farmers of this State have abundant cause for devout thanksgiving. Considering the unfavorable beginning of the planting season and the severe drought of the summer and autumn, the total output of the harvest is gratifyingly large, giving a most striking illustration of the productiveness of this region.

**CORN.** The average yield of this leading crop of the State is shown by the reports of over seven hundred correspondents to be thirty-five and seven-tenths (35.7) bushels per acre above the average of the past fifteen years. The number of acres planted this year in Iowa, as shown by the reports of assessors and correspondents, was 6,016,940; indicating a total yield of 214,804,758 bushels, which is over 40,000,000 in excess of last year's product. The average market price December 1st was 25 cents a bushel.

**WINTER WHEAT.** The area of winter wheat harvested this year was 283,553 acres. The average yield was 15.4 bushels per acre, giving a total product of 3,690,137 bushels.

**SPRING WHEAT.** Average, 12.4 bushels per acre; acres harvested, 620,626; product, 7,695,762 bushels. Total winter and spring wheat yield, 11,385,899 bushels. Average price, 49 cents.

**OATS.** Acreage harvested, 4,197,623; average yield, 28 bushels per acre; total product, 100,742,852 bushels. Average price, 22 cents.

**RYE.** Average yield per acre, 16.3 bushels; area harvested, 109,528; total product, 1,785,202 bushels. Average price, 35 cents.

**BARLEY.** Average yield per acre, 22.8 bushels; number of acres, 506,091; total product, 11,437,666 bushels. Average price, 32 cents.

**FLAX.** Average yield per acre, 9.1 bushels; number of acres, 248,776; total product, 2,263,861 bushels. Average price, 86 cents.

**BUCKWHEAT.** Average yield per acre, 13.8 bushels; acres harvested, 31,042; total yield, 428,379 bushels. Average price, 63 cents.

**IRISH POTATOES.** Average yield per acre, 59.2 bushels; acres planted, 104,261; total product, 6,172,257 bushels. Average price, 66 cents.

**SWEET POTATOES.** Average yield per acre, 64.8 bushels; total yield (estimated), 180,440 bushels. Average price, \$1.40.

**TIMOTHY SEED.** Average yield per acre, 4 bushels; acreage, 164,104; total product, 656,416 bushels. Average price, \$1.40.

**CLOVER SEED.** Average yield, 2 bushels per acre; total area, 54,538; product, 109,076 bushels. Average price, \$5.48.

**MILLET SEED.** Average per acre, 19.3 bushels; acreage, unknown.

**SORGHUM.** Average yield, 85.6 gallons per acre; area planted, about 6,517; yield, 557,855 gallons. Average price, 46 cents.

**BROOM CORN.** Number tons raised, 1,735; average price, \$63.65.

**HAY.** Average yield, 1.7 per acre; acreage, exclusive of prairie hay, 2,687,858 acres; total product, 4,569,341 tons. Average price, \$5.22 per ton.

**PRAIRIE HAY.** Estimated average yield per acre, 1.4 tons; acres cut, 2,009,403; total product, 2,813,164 tons. Average price, \$3.00 per ton.

**OLD CORN AND OATS.** The average amount of old corn (crop of 1892) in farmers' hands is 4 per cent—approximately, 6,000,000 bushels. The average amount of last year's oats on hand is also about 4 per cent.

**WOOL.** The average price of wool is 14 cents per pound.

**MILCH COWS**—The average price of milch cows is \$24.30 per head.

### GENERAL CROP SUMMARY, 1893.

PRODUCTS.	Number of acres.	Average per acre.	Total product	Market value Dec. 1.
Corn.....	6,016,940	35.7	214,804,758	\$ 53,701,189
Winter wheat.....	233,553	15.8	3,690,137	1,845,068
Spring wheat.....	629,626	12.4	7,805,762	3,617,008
Oats.....	4,197,623	24	100,742,852	22,163,427
Rye.....	109,528	16.3	1,785,102	621,820
Barley.....	506,091	22.6	11,437,656	3,669,049
Flax.....	248,776	9.1	2,243,861	1,946,920
Buckwheat.....	31,042	13.8	428,379	269,878
Irish potatoes.....	104,261	59.2	6,172,251	3,963,885
Sweet potatoes.....	28,000	.....	181,440	254,016
Timothy seed.....	164,104	4	656,416	918,972
Clover seed.....	54,538	2	109,076	497,736
Sorghum.....	6,517	85.6	557,855	256,613
Hay.....	2,687,848	1.7	4,569,341	23,850,959
Prairie hay.....	2,009,403	1.4	2,813,164	8,439,492
Broom corn.....	.....	.....	1,735	110,432
Pasturage.....	.....	.....	.....	*35,000,000
Total.....	.....	.....	.....	\$ 161,207,464

\*Estimated value.

In the above summary no account is made of the products of the orchards, vineyards and gardens, which amount to a considerable sum. The total yield of farm crops exceeds that of last year, but the average market prices on December 1st were materially lower than on the corresponding date in 1892. The actual value of the soil products of the State is by no means to be estimated at the current market prices December 1st, which on that date are usually lower than at other seasons of the year. And there is generally a large increase in value in using these products as raw material in the manufacture of pork, beef, butter, poultry, sheep, horses, etc. It would be safe to estimate the total value of all soil products of this State for the year 1893, in round numbers, at \$200,000,000.



## WEATHER CROP BULLETINS.

SUMMARIES OF WEEKLY BULLETINS ISSUED DURING THE SEASON OF 1893.  
ILLUSTRATING THE MUTATIONS AND VICISSITUDES OF AGRICULTURE.

### BULLETIN No. 1. APRIL 11.

After a winter of unusual severity the crop season of 1893 opens under very favorable conditions. In nearly all portions of the State the snow afforded ample protection to the soil against the extreme cold, and the frost was well out of the ground by the first of the month. Farming operations were begun a week or more earlier than in the average of recent years, and the greater portion of the seeding is already completed, with an increased acreage of small grain, except spring wheat.

The soil never was in better condition for the reception of seed. While it is generally dry, no damage has resulted as yet, and with favorable conditions of heat and moisture in the future the crop outlook is flattering.

An increased area of winter wheat was planted last fall, though the acreage is as yet relatively light. The autumn drought checked its germination to some extent and the plant was not in favorable condition to withstand the winter; its percentage of condition is therefore quite low, especially in some of the southern counties where the snowfall was light. In some localities reports show that it is in healthy condition; in others it is very poor.

Very rapid progress is being made in the preparation of corn ground, and if the favorable weather continues planting will begin about the middle of the month.

The daily temperature of the past week averaged about ten degrees above the normal, and the rainfall was generally deficient.

### BULLETIN No. 2. APRIL 18.

Generally low temperature with high winds prevailed during the larger part of the past week, checking the growth of vegetation and retarding farming operations. The daily average temperature was about 7° below the seasonable normal and ice formed on four days during the week. The amount of sunshine was somewhat below the average. The rainfall was ample and well distributed except in portions of the southwestern district, and in that section winter wheat has been considerably damaged by the freezing weather, high winds and drouth. Fruit is not far enough advanced to be extensively injured.

The sowing of small grain is practically completed, and preparations for corn planting are in full progress. In the southeastern district a start has already been made in planting. The soil is in excellent tilth in all portions of the State, and the season is earlier than usual.

Considerable damage is reported from the severe local windstorms of the 11th inst., but this State did not suffer the most destructive effects of that extensive cyclonic disturbance.

BULLETIN NO. 3. APRIL 25.

Very unseasonable weather prevailed the larger part of the past week, and no progress has been made in farm work or in the growth of vegetation. The mean daily temperature averaged over 9° below the seasonable normal.

The amount of precipitation was generally excessive, except in a few of the southwestern counties.

The storm which began on the 19th in the form of rain, terminated in a wintry blizzard with heavy snowfall, which in some localities drifted so badly that trains were delayed. This was followed by freezing temperature in all portions of the State, with a minimum at the Central Station of 22°.

The extent of damage resulting from this abnormal weather can not as yet be determined, but it is not believed to be very serious. In the southern districts some of the earlier varieties of fruits are probably injured to some extent but in the larger part of the State the buds are not sufficiently advanced to be injured by the frosts.

There are a few reports of injury to oats, but it is not believed to be extensive. On the whole the outlook is not at all discouraging; the season is still early, and good progress has been made in seeding and preparations for planting.

BULLETIN NO. 4. MAY 2.

The past seven days were cold, stormy and generally sunless, making the third consecutive week of unfavorable weather during the first month of the crop season. The daily temperature of the week was about 8° below the seasonal normal. The precipitation was above the average in all parts of the State, and greatly in excess in the Northwest district. In all the northern districts there was a snowfall of from three to twelve inches in depth; and drifts are reported in some sections, remnants of the blizzard of April 20th.

Reviewing the month of April it may be stated that the first decade was exceptionally warm and favorable to seeding and preparation for planting; and notably good progress was made in farm work. The balance of the month was extremely cold, stormy and cloudy, retarding all field work and checking the growth of vegetation. The daily mean temperature was about four degrees below the normal, and precipitation from 2.50 to 4.00 inches in excess of the April average.

The season is somewhat later than an average; but the conditions are more favorable than they were on May 1, 1892.

Grass and winter grain have been benefited by the wet weather; but there are many reports of the rotting of small grain that had not germinated before the middle of April; the extent of damage from this cause cannot now be estimated.

There are reports from all sections of the State of the destruction of young pigs by excessive cold and moisture, and it is probable that the spring pig crop of Iowa will, this year, fall 20 to 25 per cent below the average.



## BULLETIN No. 5. MAY 9.

Another cold, wet and cloudy week has been added to the record of this unfavorable season. The daily mean temperature was about 12 degrees below the normal, and in the larger part of the State the rainfall was excessive.

The average sunshine throughout the State was less than 30 per cent of the normal.

Some progress, however, was made in preparation for planting, and with favorable weather a large acreage of corn will be planted.

The reports show considerable loss of seed on lands that have been continuously water soaked, with an occasional freezing.

The percentage of loss of young pigs will undoubtedly be somewhat greater than the estimate in last week's bulletin.

The correspondents of this Bureau, representing every county in the State, have made a special report of the amount of corn and oats, last year's crop, remaining in hands of producers. The average of their estimates is Corn, 18 per cent; oats, 16 per cent. In the dairy districts, comprising about one-third of the State, the farmers feed much more corn than they raise.

## BULLETIN No. 6. MAY 16.

The latter half of the past week brought a favorable change in the weather, making the average temperature of the week about normal. The amount of rainfall was slightly excessive in the southern, western and northeastern districts, causing some delay in farm operations. Considerable progress has been made in plowing and corn planting, and the soil is generally in good condition. With favorable weather the bulk of the planting will be completed this week.

The reports from all sections note a decided improvement in small grain pastures and meadows. The loss from rotting of seed will not be as heavy as previous reports indicated.

From all accounts it is evident there has been an unprecedented loss in the crop of spring pigs.

## BULLETIN No. 7. MAY 23.

This has been an ideal week for corn planting and other farm work, with seasonable temperature, an abundance of sunshine and very little rainfall. And the time has been well improved in all sections of the State. Planting is practically completed, except in localities where plowing had been delayed by excessive moisture. The reports indicate that the acreage in corn will exceed that of last year, but it is not likely to be greater than the average of former seasons.

The soil is in excellent tilth, and with a few exceptions the seed is sprouting unusually well. The light showers which came on Monday of the present week were timely and beneficial to all crops. Oats and other spring grain generally show an improvement; but there are numerous reports that the oats crop has made a thin stand. Pasturage is now abundant, and meadows are unusually promising.

The season has been quite favorable for the germination of grass seed and clover. The fruit prospect is generally very good. Compared with last year the season is ten days earlier.

## BULLETIN No. 8. MAY 30.

The past week was unseasonably cool, with less than the usual amount of sunshine. The daily average temperature was about seven degrees below the normal; light frosts were reported in various localities on the 27th, but no considerable damage resulted. The rainfall was excessive in the southeast, and in a number of counties in the west central districts; in the other sections it was about the average.

The week has been favorable to grass and small grain, but it was too cool for the quick germination and normal growth of corn. Cultivation of the latter crop is now quite general, and not more than the usual amount of replanting will be necessitated because of defective seed and the ravages of wire worms. In general the stand is good, and the conditions favorable.

## BULLETIN No. 9. JUNE 6.

The past week brought variable weather, but in the larger part of the State the conditions were fairly good for farm work and the advancement of crops. The daily mean temperature was about two degrees below the normal. The amount of rainfall was slightly below the seasonal average in the larger part of the State, except in the southeast and east central districts, where there was an excess of moisture and cloudiness. Cultivation of corn is in progress; the condition of the crop is variable, but the average stand is good. Considerable replanting has been necessitated by defective seed and other causes; but probably not much more than the average amount of this work has been done. The reports show a large increase in the acreage planted, compared with last year.

Oats and other spring grains have made good advancement. Pasturage is abundant, and a heavy hay crop is assured.

The crop of apples will fall considerably below the average. Small fruit will be abundant.

## BULLETIN No. 10. JUNE 13.

The temperature of the past week was very near the seasonable average, the first half being below and the last half above the normal. The rainfall was abundant in all sections, and excessive in many localities, the reported measurements ranging from two to five inches, resulting in some local damage to crops by washing and overflow.

Generally, however, the weather was favorable for all crops, the generous showers being followed by bright sunshine and warm winds. Good progress has been made in the cultivation of corn, which now shows a fairly good stand and is generally clean. In the re-planted area the prospect is flattering for a full crop.

Oats show a thin stand in some localities and a tendency to rank growth in others; but with favorable conditions in the future it will be a much better crop than last year.

Pastures and meadows are luxuriant, except where the clover plant was winter-killed.

## BULLETIN No. 11. JUNE 20.

The past seven rare June days have pushed all crops rapidly forward. The daily mean temperature was above the normal, and the sunshine was in excess of the average. The amount of rainfall was light, except in a few localities which report excessive moisture.

Corn has made wonderful growth; the soil is generally in good tilth, and the second cultivation is in progress. If the season continues favorable Iowa will celebrate the Columbian year by exceeding its former high record as a corn-producing State.

Oats and other small grain crops have made good progress. In some localities a rank growth is reported. The season has been exceptionally favorable for pastures and meadows, and the hay crop will be heavy where the grass roots were not winter-killed or injured by insects. Small fruit is abundant. The apple crop will be very light.

BULLETIN No. 12. JUNE 27.

The daily mean temperature during the past week was slightly above the normal, and there was an average amount of sunshine.

The rainfall was ample, but was unequally distributed. In portions of the southeast and south central districts heavy showers, accompanied by wind, caused some local damage to crops and light structures, and delayed cultivation.

Generally, however, the conditions have been favorable for all crops, and satisfactory progress has been made. Corn is unusually clean in nearly all portions of the State, and the plant has reached a seasonable stage of growth. Within the coming week the more advanced fields will be "laid by."

Heavy winds and showers caused oats to lodge somewhat in many localities, but the bulk of the crop will come up again. Potatoes are doing notably well.

A good beginning has been made in hay cutting, with prospects of a fair yield. Pastures were never better at this season of the year.

BULLETIN No. 13. JULY 4.

Seasonable temperature, an abundance of sunshine, and very light rainfall characterized the past week, making it exceptionally favorable for farm work and the advancement of all crops. It was a fitting close to the month of June, which in this State was seldom equalled and never excelled.

The cultivation of corn is about completed in all parts of the State. The fields are very clean, and the crop was never more promising at this season of the year.

Haying is in progress, the yield ranging from fair to very heavy.

Oats are heading; the crop as a whole will fall somewhat below the average.

Harvest of winter wheat will begin next week in the southern districts.

In some localities pastures and potatoes are beginning to show the need of more rain; but generally the moisture is ample for present needs.

BULLETIN No. 14. JULY 11.

The daily mean temperature of the past week was slightly above normal. The rainfall was generally abundant, and excessive measurements are reported from the following counties: Hamilton, 4.23 inches; Franklin, 3.27; Poweshiek, 3.12; Jasper, 3.10; Howard, 2.83; Hancock, 2.36; Monona, 2.25; Allamakee, 2.62; Polk, 2.14; Black Hawk, 2.26; Webster, 2.02; Washington, 2.15; Buena Vista, 3.47.

Nearly all crops have been benefited by these copious rains; but in some localities damage resulted from washing and overflow.

The most serious drawback to the generally favorable weather conditions of the week was the tornado of the evening of the 6th inst. which destroyed the thriving little town of Pomeroy, and wrought great destruction of life, buildings and crops in a pathway sixty miles in length and one-third of a mile wide, the line of desolation reaching from Cherokee county to the eastern part of Calhoun.

Outside of this track, however, the damage by wind was not very heavy, and the general crop output will not be materially reduced by the severe local storms of the week.

BULLETIN No. 15. JULY 18.

This has been the warmest week of the season, the daily temperature averaging two degrees above normal. The rainfall was light except in scattered localities which report heavy showers, accompanied by brisk to high winds.

Corn has made rapid advancement, and at this season of the year there has never been a brighter prospect of a large crop of this important staple.

Fall wheat and rye are in shock or stack, in prime order. Haying is in progress, and the bulk of the crop has been put up, generally in good condition. The cutting of barley has begun, and in the southern districts the harvest of oats will be commenced this week. In many localities oats and spring wheat are somewhat affected by rust, in consequence of the high temperature and humidity.

BULLETIN No. 16. JULY 25.

The past seven days were hot, with almost uninterrupted sunshine; but the nights were relatively cool, reducing the daily average temperature to about two degrees below normal.

The amount of rainfall was very light, the larger part of the State receiving none since the 15th.

The weather has been all that could be desired for hay making, and a large amount has been secured in excellent condition, the work being practically completed.

Oats harvest is in progress in the northern and central districts, and in the southern districts it is about finished. Reports of extensive damage by rust are received from the southern and central districts; also from scattered localities in the northern belt. While the acreage is large, the oats crop is likely to fall 20 to 30 per cent below the average. Spring wheat is also affected by rust.

Corn is making a stalwart growth in all parts of the State, and is very promising. It would be benefited, however, by slight showers, and all immature crops are beginning to show the effects of drouthy conditions.

BULLETIN No. 17. AUGUST 1.

The daily average temperature of the past week was slightly above the normal. Except in a few favored localities the rainfall was deficient for the needs of the growing crops, and drouthy conditions still prevail over the larger part of the State.

Corn is doing notably well, however, and no reports of material damage have been received at the Central Station.

The majority of the crop correspondents of this bureau, in their reports for August 1st, use three figures to express the present condition of corn.

The week was favorable for harvesting, and except in the northern districts the bulk of small grain has been secured. Nearly all reports show heavy injury to oats by rust, and judging by partial returns the State at large will not produce over two-thirds of an average crop.

All immature crops need rain.

BULLETIN No. 18. AUGUST 8.

This has been a dry, warm week, with a superabundance of sunshine.

Light showers were reported, affording partial relief from the prevailing drought within a small area; but in the larger part of the State there was only a trace of rain. The nights, however, were cold, and heavy dews helped the crops.

The status of corn has probably been somewhat lowered, especially in the southern and central districts. But with abundant rains in the near future the State will produce a large crop of that staple.

Harvesting and threshing operations have been uninterrupted, and small grain crops secured in good condition. All threshing reports show a light yield and poor quality of oats and spring wheat. Winter wheat returns are variable, ranging from 4 to 30 bushels per acre.

The regular August reports from township correspondents show the following average per cent of crops: Winter wheat, 87; spring wheat, 76; corn, 101; oats, 67; barley, 90; potatoes, 80; flax, 92; millet, 90; sweet potatoes, 88; pastures, 86 per cent.

BULLETIN No. 19. AUGUST 15.

The severe drought was broken or mitigated by the showers of the 10th inst., followed by cooler and partly cloudy weather. The rainfall was abundant in many localities, and insufficient in others, but on the whole of inestimable value to corn, potatoes and pastures.

A few reports indicate material damage to corn by drought, but in the larger part of the State there is yet promise of a full average crop.

The damage to potatoes is irreparable.

Threshing reports continue to show yield of oats from 50 to 65 per cent of average.

Estimated acreage of spring wheat, 621,305 acres. Average yield cannot exceed 11 bushels per acre; much of it light weight.

Winter wheat area, 335,000 acres. Average yield, 14 bushels, of good quality.

Total wheat product estimated at 10,124,355 bushels. Later threshing returns may slightly reduce these figures.

BULLETIN No. 20. AUGUST 22.

The daily average temperature of the past week was slightly below the normal with a large amount of sunshine.

Rainfall well distributed and above the normal except in a few scattered localities.

Corn making good progress but rapid maturity is retarded by cool nights. Rainfall amply sufficient to insure a good crop of this staple, except in a few counties in north central and northeast portion of the State.

Pastures much improved and ground in splendid condition for fall plowing.

Late potatoes benefited in some localities, but the crop will be light.

Threshing reports show that barley is yielding from 25 to 30 bushels per acre. Oats from 50 to 60 per cent of an average crop.

**BULLETIN No. 21. AUGUST 29.**

The temperature of the past week was slightly below the normal, the days being warm and the nights cool.

The amount of rainfall was very light and poorly distributed, the larger part of the State receiving none.

Under these conditions corn is maturing rapidly, and except in a few localities will make a good crop without more rain.

Rain is greatly needed, however, in nearly all sections for pastures, and to facilitate plowing.

A good beginning has been made in plowing, and in the southern district some fall grain has been planted. With favorable weather there will be a large increase in the acreage of fall wheat.

**BULLETIN No. 22. SEPTEMBER 5.**

The past week was excessively cool and dry, the temperature reaching the frost line on three mornings, resulting in light damage to crops in low places.

The daily average deficiency was about six degrees; the days were bright and the nights cool.

The drought is especially severe upon pastures, necessitating the feeding of stock in the dairying districts. The ground is generally too dry for plowing and the seeding of fall wheat and rye will be materially lessened.

The splendid corn crop of the State is coming down the home stretch in fine shape, rapidly nearing the line of safety from frost. At least 25 per cent is now practically safe, and cutting is now in progress. The bulk of the crop will be matured by the 15th and the straggling fields will be in line by the 20th under normal weather conditions.

**BULLETIN No. 23. SEPTEMBER 12.**

Another hot, dry and cloudless week has intensified the drought and increased its damaging effects. The daily mean temperature of the week was about seven degrees above the normal, and but little more than a trace of rainfall is reported from any station within the State. The power of the sunshine was somewhat mitigated, however, by hazy and smoky atmosphere.

Under these conditions corn has been too rapidly pushed towards maturity for its complete development, and the later fields will be light in weight. Probably three-fourths of the crop is now practically safe from damage by frost, and another week will place 90 per cent beyond danger. More than the usual amount of cutting has been done.

The pastures are very dry, and many farmers have been obliged to draw upon their stores of winter forage to feed their stock. This lengthening of the feeding season nearly two months will materially reduce the prospective surplus of hay and other forage crops of this State.

The soil is generally too dry to plow, and comparatively little seeding of fall grain has been done. As a result the acreage of fall wheat will probably be less than last year, and much below the area that would have been planted under favorable conditions.

## BULLETIN No. 24. SEPTEMBER 18.

The severe drought continued through the past week, the average temperature being about 6 degrees above the normal, and but little more than a trace of rain is reported in any part of the State.

Corn is generally well matured, and is practically safe from damage by frost. Late planted fields have been materially injured by the drought, but it is certain the average per acre and quality will be considerable above the crop of 1892. The area planted in corn in Iowa this year is about six million acres. All estimates based on a greater acreage are unreliable.

The area of wheat harvested this year was about 875,000 acres; and of oats, 4,197,000 acres.

These figures are based upon the tabulated reports of township assessors for the current season.

## BULLETIN No. 25. SEPTEMBER 25.

The daily average temperature of the past week was slightly above the normal, ending with a cold wave and severe frost on the morning of the 25th. The rainfall was deficient in the larger part of the State, but the southern and eastern counties report heavy showers, resulting in a marked improvement of pasturage.

All crops are safe. Corn is drying rapidly and will be ready to crib much earlier than usual. Estimates of the average yield show a variable condition, the majority of correspondents placing it at or above 40 bushels per acre. It is believed that the final report of the season will show better than an average crop, and not far from 40 bushels. This will give the State a total of about 240,000,000 bushels; this estimate is subject, of course, to revision after husking returns.

It is still too dry to plow in the larger part of the State, and feeding of stock is quite general. The amount of seeding of fall grain will be much less than last year.



ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
ALGONA, KOSSUTH COUNTY.

BY C. D. PETTIBONE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	8.1	34	-18	0.31	3.5	.....
February.....	11.7	38	-24	2.04	20.4	NW
March.....	28.4	66	-4	2.20	8.0	NW
April.....	43.4	76	24	4.25	11.0	NW
May.....	57.0	86	36	2.31	.....	NW
June.....	73.2	91	56	1.69	.....	SW
July.....	73.2	94	62	1.87	.....	NW SW
August.....	68.5	96	46	0.40	.....	NW SW
September.....	62.8	93	27	1.90	...	NW
October.....	49.4	85	15	0.02	.....	NW
November.....	31.9	72	-10	0.60	4.5	NW
December.....	17.7	44	-14	1.60	5.0	NW
Sums.....	.....	.....	.....	19.19	52.4	.....
Averages.....	43.8	96	-24	...	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	12.5	44	-24	3.95	.....	NW
Spring months.....	42.9	86	-4	8.76	.....	NW
Summer months.....	71.6	96	46	3.96	.....	NW SW
Autumn months....	48.0	93	-10	2.52	.....	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
ALTA, BUENA VISTA COUNTY.

BY DAVID HADDEN, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	7.4	37	-18	0.26	2.5	.....
February.....	11.0	37	-22	1.32	13.0	NW
March.....	26.7	61	-8	2.60	6.0	NW
April.....	41.0	79	18	3.14	7.0	NW
May.....	54.6	80	31	3.65	.....	SE NW
June.....	70.8	89	44	5.48	.....	S
July.....	72.9	93	53	4.61	.....	S
August.....	68.5	95	40	1.73	.....	S
September.....	64.6	95	24	1.02	.....	SE
October.....	49.9	85	15	0.23	.....	NW
November.....	31.0	74	-9	0.96	6.2	NW
December.....	17.0	48	-13	1.40	4.2	NW
Sums.....	.....	.....	.....	26.40	38.9	.....
Averages.....	43.0	95	-22	...	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	11.3	48	-22	2.68	.....	NW
Spring months.....	40.8	86	-8	9.39	.....	NW
Summer months....	70.7	95	40	11.82	.....	S
Autumn months....	48.5	95	-9	2.21	.....	NW



ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
AMANA, IOWA COUNTY.

BY CONRAD SCHADT, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	7.5	39	-10	0.55	4.9	NW
February.....	15.6	40	-17	1.85	8.4	NW
March.....	48.8	71	3	2.52	2.0	NNW
April.....	45.6	83	24	4.48	2.0	NW
May.....	58.6	85	32	2.29		NEW
June.....	71.2	93	48	4.28		SE
July.....	76.3	96	51	2.70		SE
August.....	69.4	96	39	2.02		SE
September.....	63.4	93	28	2.62		SE
October.....	51.0	82	19	2.02		NW
November.....	33.1	70	-1	1.73	4.0	NW
December.....	21.4	67	-10	1.22	5.0	NW
Sums.....				28.90	24.3	
Averages.....	45.2	96	-19			NW
RECAPITULATION BY SEASONS—						
Winter months.....	14.8	67	-10	3.12		NW
Spring months.....	44.8	85	3	2.49		NW
Summer months.....	72.0	96	30	10.00		SE
Autumn months.....	49.5	93	-1	6.38		NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
AMES, STORY COUNTY.

BY JAS. J. EDGERTON, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	10.1			0.36	6	
February.....	13.4	40	-24	1.98		NW
March.....	30.1	73	-5	3.04	7	NW SE
April.....	44.0	77	17	6.22		NW
May.....	55.0	83	31	4.33		NW
June.....	69.5	90	47	4.90		SE
July.....	73.2	95	50	2.00		SE
August.....	68.0	97	38	1.62		SE
September.....	62.2	96	21	1.97		SE
October.....	51.1	87	15	0.66		NW
November.....	32.4	72	-3	0.66		NW
December.....	16.5	56	-12	1.28		NW
Sums.....				36.90		
Averages.....	43.8	97	-24			NW
RECAPITULATION BY SEASONS—						
Winter months.....	40.0	66	-24	3.42		NW
Spring months.....	139.1	83	-5	11.60		NW
Summer months.....	210.7	97	38	8.62		SE
Autumn months.....	145.7	96	-1	8.87		NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
AMES, STORY COUNTY.

BY ISAAC YOUNG, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	8.4	39	21	0.34		
February.....	17.9	44	-20	1.87	4.8	NW
March.....	31.1	70	-4	1.73	2.2	NW
April.....	44.8	76	22	2.42	6.0	NWSE
May.....	54.5	82	32	4.69		NWNE
June.....	72.7	94	50	4.79		SE
July.....	79.1	102	58	2.47		SSW
August.....	72.5	98	40	1.08		SW
September.....	67.7	100	30	1.86		NW
October.....	54.6	88	20	0.52		NW
November.....	38.8	60	-2	0.62	2.32	NW
December.....	22.5	56	-8	1.05	8.53	NW
Sums.....				23.99		
Averages.....	46.6	102	-21			NW
RECAPITULATION BY SEASONS—						
Winter months.....	46.8	56	-21	2.70		NW
Spring months.....	129.9	82	-4	9.04		NW
Summer months.....	236.3	102	46	8.25		SW
Autumn months.....	158.5	100	-2	3.00		NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
ATLANTIC, CASS COUNTY.

BY J. W. LOVE, VOLUNTARY OBSERVER.

MONTH.					
January.....					
February.....					
March.....					
April.....					
May.....					
June.....					
July.....					
August.....					
September.....					
October.....					
November.....					
December.....					
Sums.....					
Averages.....		102	-21		
RECAPITULATION BY SEASONS—					
Winter months.....	17.6	55	-21	3.45	NW
Spring months.....	45.7	89	-3	7.90	N NW
Summer months.....	71.8	102	24	12.72	S
Autumn months.....					

## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
AUDUBON, AUDUBON COUNTY.

BY J. F. HOCKER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	11.0	40	-17	0.48	4.6	NW
February.....	15.3	40	-20	1.52	15.2	NW SW
March.....	31.0	75	-3	1.55	1.0	NW
April.....	45.9	76	20	3.21	5.6	NW
May.....	58.0	90	28	4.54	...	NW
June.....	71.6	92	44	4.03	...	SW
July.....	74.9	97	50	2.38	...	S
August.....	71.4	97	36	1.95	...	S
September.....	63.5	94	25	1.48	...	SW
October.....	52.0	84	18	0.18	...	SW
November.....	33.3	70	-4	1.00	6.0	NW
December.....	22.2	56	-11	1.55	8.0	NW
Sums..	.....	.....	.....	24.80	40.4	.....
Averages.....	45.8	97	-20	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	16.2	56	-20	3.55	.....	NW
Spring months.....	45.0	90	-3	9.50	.....	NW
Summer months.....	72.6	97	36	9.29	.....	S
Autumn months.....	49.6	94	-4	2.66	.....	SW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
BELLE PLAINE, BENTON COUNTY.

BY H. W. VANDYKE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	6.7	39	-20	0.95	9.0	NW
February.....	14.8	41	-18	1.20	6.0	NW
March.....	31.7	73	2	2.49	4.5	SE NW
April.....	45.0	84	21	3.55	5.0	SE
May.....	55.6	95	30	3.24	.....	NW SE
June.....	71.0	91	47	3.43	.....	SE
July.....	73.8	95	50	2.24	.....	S
August.....	69.2	97	40	1.99	.....	N NW
September.....	65.8	92	26	1.96	.....	SE
October.....	51.8	84	17	2.67	.....	S
November.....	32.8	71	-5	1.51	7.5	S
December.....	20.2	55	-10	1.17	9.5	W
Sums.....	.....	.....	.....	26.35	41.5	.....
Averages.....	44.8	97	-20	.....	.....	NW SE
RECAPITULATION BY SEASONS—						
Winter months.....	41.7	55	-20	3.27	.....	NW
Spring months.....	132.3	85	2	9.28	.....	SE NW
Summer months.....	214.0	97	40	7.66	.....	S SE
Autumn months.....	140.9	92	-5	6.14	.....	S

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
BLAKEVILLE, BLACK HAWK COUNTY.

BY JAMES RODGERS, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	6.1	34	-22	2.20	22.0	NW
February.....	14.3	42	-20	2.55	11.5	SE
March.....	29.8	61	-2	3.54	11.0	NW
April.....	43.0	80	26	3.94	7.0	NW
May.....	55.3	84	33	3.38	...	NW
June.....	71.8	93	54	3.80	...	SE
July.....	77.4	96	61	2.68	...	SW
August.....	72.1	94	49	1.12	...	SW NW
September.....	67.6	100	32	0.85	...	SE
October.....	53.6	86	16	4.56	...	SE
November.....	...	...	...	...	...	...
December.....	...	...	...	...	...	...
Sums.....	...	...	...	...	...	...
Averages.....	...	...	...	...	...	...
RECAPITULATION BY SEASONS—	...	...	...	...	...	...
Winter months.....	...	42	...	...	...	...
Spring months.....	42.7	84	...	10.84	...	NW
Summer months.....	73.7	96	...	7.08	...	SW
Autumn months.....	...	100	...	...	...	...

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
BONAPARTE, VAN BUREN COUNTY.

BY B. R. VALE, VOLUNTARY OBSERVER.

MONTH.	TE.					
	Mean.	1	2	3	4	5
January.....	12.7	42	-14	0.80	2.0	NW
February.....	20.9	44	-11	1.42	8.0	NW
March.....	36.0	79	-5	2.79	...	NW
April.....	48.8	80	23	5.11	...	NW
May.....	58.3	88	44	4.81	...	...
June.....	71.9	95	40	4.27	...	...
July.....	77.0	98	52	2.46	...	...
August.....	71.6	101	40	2.02	...	...
September.....	67.6	100	31	5.13	...	...
October.....	55.1	91	23	1.46	...	...
November.....	36.6	75	4	1.61	2.5	...
December.....	25.7	63	-8	1.17	7.0	...
Sums.....	...	...	...	32.84	...	...
Averages.....	48.5	101	-14	...	...	...
RECAPITULATION BY SEASONS—	...	...	...	...	...	...
Winter months.....	19.8	63	-14	3.19	...	...
Spring months.....	47.7	89	-5	12.21	...	...
Summer months.....	73.5	101	40	8.75	...	...
Autumn months.....	53.0	100	4	8.19	...	...

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CARROLL, CARROLL COUNTY.

BY MOSES SIMON, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	18.1	40	-15	0.85	5	
February.....	30.1	67	-21	2.99	5	
March .....	44.0	75	-2	1.75		
April .....	56.7	84	31	3.81	0	
May .....	72.2	92	44	5.62		
June .....	75.2	94	50	4.75		
July .....	68.5	94	38	2.92		
August .....	62.0	93	28	1.36		
September...	51.0	87	18	0.10		
October .....	31.6	72	-5	0.77	0	
November .....	18.7	56	-10	1.37	5	
December .....						
Sums .....				29.63		
Averages .....		94	-21	2.47		
RECAPITULATION BY SEASONS—						
Winter months .....		56	-21	4.71		
Spring months .....	43.0	92	-2	11.68		
Summer months .....	72.0	94	38	11.31		
Autumn months .....	48.5	93	-5	2.28		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CEDAR FALLS, BLACK HAWK COUNTY.

BY PROF. A. C. PAGE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	5.8	37	-20	1.40	14.0	NW
February.....	14.6	58	-23	1.90	12.0	NW
March .....	31.1	67	2	2.78	7	NW
April .....						
May .....						
June .....	50.2	91	47	3.15		SW
July .....	75.0			4.47		
August .....	70.0		36	1.00		NW
September...	64.2		26	1.75		NW
October .....	53.1	85	15	3.53		NW
November .....	32.3	75	-7	6.65	5.5	NW
December .....						
Sums .....						
Averages .....						
RECAPITULATION BY SEASONS—						
Winter months .....						
Spring months .....						
Summer months .....	71.7			8.71		
Autumn months .....	49.9	69	-7	6.83		NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CEDAR RAPIDS, LINN COUNTY.

BY H. D. OLDS, VOLUNTARY OBSERVER.

MONTH	TEMPERATURE.			Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.		
January.....	72	75	68	7.5	NW
February.....	68	70	65	8.0	W NW
March.....	69	73	63	8.0	W
April.....	69	73	63	8.0	E
May.....	79	83	75	...	E
June.....	89	93	85	...	S
July.....	98	102	94	...	NW
August.....	87	91	83	...	NW
September.....	83	87	79	...	E NE
October.....	83	87	79	...	W NW
November.....	74	78	70	5.8	NW
December.....	60	64	56	15.4	NW
Sums., .....	30 67	43.9	...	...	...
Averages.....	46.4	94	-16	...	NW
RECAPITULATION BY SEASONS—					
Winter months.....	16.5	58	-16	4.04	NW
Spring months.....	45.4	81	5	9.87	E
Summer months.....	72.9	94	45	9.34	NW
Autumn months.....	50.6	90	3	6.72	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CENTERVILLE, APPANOOSE COUNTY.

BY J. I. ONG, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.		
January.....	12.8	41	-18	0.58	NW
February.....	21.2	46	-16	2.10	W & SE
March.....	35.9	75	2	1.10	W
April.....	48.2	85	18	4.80	SW
May.....	60.1	88	38	6.14	...
June.....	72.2	91	48	3.06	S
July.....	77.6	95	58	2.67	SW
August.....	73.9	97	44	8.20	NW
September.....	65.9	95	34	4.20	NW
October.....	54.3	81	25	1.90	NW
November.....	37.3	75	2	1.45	SW
December.....	29.4	70	-7	2.40	NW
Sums., .....	32.35	39.5	...	...	...
Averages.....	49.0	97	-18	...	...
RECAPITULATION BY SEASONS—					
Winter months.....	21.1	70	-18	5.45	NW
Spring months.....	48.0	88	2	11.04	...
Summer months.....	71.3	97	44	8.92	...
Autumn months.....	52.5	95	2	6.95	NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT CHARLES CITY, FLOYD COUNTY.

BY J. W. SMITH, VOLUNTARY OBSERVER.

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT CLARINDA, PAGE COUNTY.

BY A. S. VANSANDT, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE			Total precipitation rain and melted snow—inches.	
	Mean.	Maximum.	Minimum.		
January.....	13.2	42	-9	0.6	
February.....	18.2	46	-15	1.1	
March.....	33.0	74	2	1.7	
April.....	47.4	81	23	3.1	
May.....	57.9	82	32	3.1	
June.....	70.5	88	52	4.1	
July.....	75.3	97	58	3.5	
August.....	69.6	92	44	5.2	
September.....	65.9	90	36	2.3	
October.....	54.0	80	26	0.0	
November.....	35.2	70	-2	1.0	
December.....	25.4	57	-3	0.7	
Sums.....				33.27	20.5
Averages.....	47.1	97	-15		S
RECAPITULATION BY SEASONS—					
Winter months.....	18.9	57	-15	2.56	S
Spring months.....	46.1	82	2	3.01	NW
Summer months.....	71.8	97	44	10.18	S
Autumn months.....	51.7	90	-2	3.52	S

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
CLINTON, CLINTON COUNTY.

BY LUKE ROBERTS, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January. ....	8.3	39	-20	2.01	15.3	W
February .....	16.7	40	-18	1.68	11.5	W
March .....	34.4	70	5	2.75	2.5	NW NE
April .....	47.5	87	24	5.48	0.5	NW
May .....	57.6	86	31	3.80	.....	NW
June .....	71.8	92	51	3.72	.....	SSE
July .....	76.3	95	53	2.26	.....	SW
August. ....	70.5	96	40	1.20	.....	NE
September .....	64.4	96	31	4.25	.....	NE
October .....	52.7	82	18	0.68	.....	S
November .....	34.3	73	1	1.77	7.0	NW
December .....	23.9	61	-11	1.29	6.5	NW
Sums.....				30.39	43.3	.....
Averages.....	46.5	96	-20	2.53	.....	NW
RECAPITULATION BY SEASONS—						
Winter months...	18.3	61	-20	4.98	.....	W
Spring months ...	46.5	87	5	12.08	.....	NW
Summer months. ....	72.9	96	40	6.68	.....	SSE
Autumn months. ..	50.5	96	1	6.70	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
COLLEGE SPRINGS, PAGE COUNTY.

BY A. A. BERRY, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipita- tion rain and melted snow— inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.. ....	12.6	43	-13	0.20	2.0	NW & W
February ...	18.9	44	-17	1.89	13.0	S & NW
March .....	33.7	78	- 0	1.80	4.5	NW
April .....	48.8	80	24	3.80	.....	S & NW
May .....	58.5	85	34	3.61	.....	N
June .....	70.2	92	44	4.37	.....	S
July .....	74.3	97	55	6.13	.....	S
August. ....	68.0	90	42	3.54	.....	S
September .....	.....	.....	.....	3.29	.....	S
October .....	.....	.....	.....	.....	.....	.....
November .....	36.6	72	6	1.02	1.5	N
December .....	26.5	59	-4	0.99	7.0	S
Sums.. ....						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....	19.3	59	-17	3.08	.....	S & NW
Spring months.....	47.0	85	0	9.21	.....	NW
Summer months.....	70.8	97	42	14.04	.....	S
Autumn months .....						



# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT CORNING, ADAMS COUNTY.

BY JOHN W. BIXBY, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	13.1	42	-14	0.25	2.5	NW
February.....	18.3	49	-17	0.45	1.5	NW
March.....	33.2	74	0	2.31	9.8	NW
April.....	47.2	79	20	3.76	4.0	NW
May.....	57.1	82	29	3.27	.....	NE
June.....	69.4	87	44	3.82	.....	SE
July.....	73.2	95	50	4.18	.....	SW
August.....	67.7	90	40	6.16	.....	SW
September.....	64.7	91	20	1.70	.....	SW
October.....	54.2	84	21	0.22	.....	SW
November.....	37.4	72	2	1.10	0.2	SW
December.....	26.3	59	-5	0.62	3.5	NW
Sums.....	.....	.....	.....	28.04	21.5	.....
Averages.....	46.8	95	-17	.....	.....	NW&SW
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	19.3	59	-17	1.52	.....	NW
Spring months.....	45.8	82	0	9.34	.....	NW
Summer months.....	70.1	95	40	14.16	.....	SW
Autumn months.....	62.1	91	2	3.02	.....	SW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT CRESCO, HOWARD COUNTY.

BY GREGORY MARSHALL, VOLUNTARY OBSERVER.

MONTH	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	2.5	30	-24	1.16	10.0	NW
February.....	9.8	44	-27	1.72	6.0	.....
March.....	40.2	77	15	5.95	.....	NW
April.....	52.9	82	30	2.79	.....	NW
May.....	68.2	89	45	4.14	.....	SW
June.....	71.1	93	50	3.85	.....	.....
July.....	67.4	94	38	1.20	.....	SW
August.....	.....	.....	.....	.....	.....	.....
September.....	49.0	81	14	3.40	.....	S
October.....	29.5	72	-12	0.64	6.0	NW
November.....	15.4	46	-17	1.17	2.5	NW
December.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	9.1	48	-27	3.56	.....	.....
Spring months.....	.....	.....	.....	.....	.....	.....
Summer months.....	68.9	93	38	9.19	.....	.....
Autumn months.....	.....	.....	.....	.....	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DAVENPORT, SCOTT COUNTY.

BY T. J. WALZ, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	9.2	39	-15	1.14	.....	W
February.....	17.4	42	-14	1.69	.....	W
March.....	34.0	74	6	2.25	.....	W
April.....	47.0	86	27	4.50	.....	E
May.....	58.0	83	37	2.67	.....	NE
June.....	72.0	93	51	3.82	.....	E
July.....	77.0	94	54	1.75	.....	SW
August.....	72.0	94	46	1.12	.....	NW
September. .	66.6	96	37	3.36	.....	SW
October.....	54.7	82	24	0.80	.....	S
November.....	36.0	71	4	2.56	.....	SW
December.....	24.0	59	-8	1.67	.....	W
Sums.....	.....	.....	.....	27.33	.....	.....
Averages.....	47.3	96	-15	.....	.....	W SW
RECAPITULATION BY SEASONS—						
Winter months.....	16.9	59	-15	4.50	.....	W
Spring months... ..	43.3	86	6	9.42	.....	E NE
Summer months.....	73.7	94	46	6.69	.....	NW SW
Autumn months. ....	52.4	96	4	6.72	.....	SW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DECORAH, WINNESHIEK COUNTY.

BY LEONARD STANDRING.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	.05	37	-36	.....	.....	.....
February.....	11.9	48	-24	1.30	1.30	.....
March.....	.....	.....	.....	.....	.....	.....
April.....	.....	.....	.....	.....	.....	.....
May.....	.....	.....	.....	.....	.....	.....
June.....	.....	.....	.....	.....	.....	.....
July.....	72.2	93	51	6.05	.....	.....
August.....	68.0	93	38	0.50	.....	.....
September.....	63.3	91	25	1.15	.....	.....
October.....	50.8	82	14	2.13	.....	.....
November.....	31.4	79	-13	1.51	4.5	.....
December.....	19.2	53	-13	1.73	5.2	.....
• Sums.....	.....	.....	.....	.....	.....	.....
Averages... ..	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	10.5	53	-36	.....	.....	.....
Spring months.....	.....	.....	.....	.....	.....	.....
Summer months.....	.....	.....	.....	.....	.....	.....
Autumn months.....	48.5	91	-13	4.79	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DELAWARE, DELAWARE COUNTY.

BY WM. BALL, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	1.6	33	-24	0.88	10.4	NW
February....	11.4	40	-23	0.97	3.0	NW
March.....	27.8	65	0	2.31	4.3	SW
April.....	41.7	84	22	3.71	3.0	NW
May.....	55.1	82	40	2.92	.....	NW
June.....	69.9	92	55	4.29	.....	SW
July.....	73.7	96	63	3.96	.....	NW S
August.....	66.9	96	46	1.06	.....	S
September.....	59.8	92	30	2.39	.....	S
October.....	48.3	83	19	3.27	.....	S
November.....	29.6	65	-8	1.81	5.5	NW
December.....	18.8	32	-10	1.44	5.3	NW
Sums.....	.....	.....	.....	29.01	31.5	.....
Averages.....	42.0	68	-24	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	10.6	52	-24	3.27	.....	NW
Spring months.....	41.5	84	0	8.94	.....	NW
Summer months.....	70.3	96	46	9.33	.....	S NW
Autumn months.....	45.9	98	-8	7.47	.....	S

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
DENISON, CRAWFORD COUNTY.

BY PHIL A. SCHLUMBERGER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	14.5	41	-15	1.15	11.5	NW
February.....	16.8	47	-16	2.45	21.5	NW
March.....	31.9	69	-2	0.64	4.0	NW
April.....	46.2	77	21	5.18	12.0	NW
May.....	.....	.....	.....	5.21	.....	.....
June.....	71.0	.....	.....	3.65	.....	S
July.....	74.9	.....	.....	2.46	.....	.....
August.....	.....	.....	.....	3.79	.....	.....
September.....	.....	.....	.....	.....	.....	.....
October.....	.....	.....	.....	.....	.....	.....
November.....	.....	.....	.....	.....	.....	.....
December.....	20.6	55	-5	0.60	6.0	W
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	17.3	55	-19	4.20	.....	NW
Spring months.....	.....	.....	.....	11.03	.....	.....
Summer months.....	.....	.....	.....	9.30	.....	.....
Autumn months.....	.....	.....	.....	.....	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DES MOINES, POLK COUNTY.

BY GEO. M. CHAPPEL, M. D., VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipita- tion rain and melted snow— inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	10.2	42	-14	0.56	7.4	NW
February.....	17.4	45	-16	1.28	6.2	NW
March.....	33.4	74	1	1.15	7.2	NW
April.....	46.0	80	22	5.61	3.2	NW
May.....	56.9	83	33	2.84	.....	NW
June.....	71.4	90	47	4.89	.....	SE
July.....	75.5	95	56	3.55	.....	SW
August.....	70.0	94	42	1.60	.....	N
September.....	66.2	95	33	1.33	.....	SW
October.....	54.8	86	22	0.22	.....	NW
November.....	35.8	72	1	1.51	8.1	NW
December.....	23.0	50	- 8	1.30	T	NW
Sums.....	.....	.....	.....	25.64	32.1	.....
Averages.....	46.7	95	-16	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	16.9	50	-16	3.14	.....	NW
Spring months.....	45.4	83	1	9.60	.....	NW
Summer months.....	72.3	95	56	9.84	.....	SE & SW
Autumn months.....	52.3	95	1	3.06	.....	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
DUBUQUE, DUBUQUE COUNTY.

BY S. C. EMERY, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	20.3	32	-23	1.00	.....	NW
February.....	15.0	40	-21	1.36	.....	W
March.....	32.0	65	5	2.52	.....	SE
April.....	45.0	80	26	4.32	.....	W
May.....	57.0	82	34	3.06	.....	N
June.....	72.0	92	52	5.40	.....	SE
July.....	76.2	96	56	3.57	.....	NW
August.....	71.0	95	44	0.54	.....	NW
September.....	64.0	94	32	3.31	.....	SE
October.....	53.3	82	22	1.66	.....	NW
November.....	36.0	72	-1	2.03	.....	NW
December.....	22.0	58	-11	1.33	.....	NW
Sums.....	.....	.....	.....	30.77	.....	.....
Averages.....	47.0	96	-23	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	19.1	58	-23	4.23	.....	NW
Spring months.....	44.7	82	5	9.90	.....	WN
Summer months.....	73.1	96	56	9.64	.....	NW
Autumn months.....	51.1	94	-1	7.00	.....	NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT EAGLE GROVE, WRIGHT COUNTY.

BY C. A. SCHAFFTER, VOLUNTARY OBSERVER.

MONTH.	Mean.	Maximum.	Minimum.	Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
January.....	2.6	30	-21	0.70	7.0	NW
February.....	6.6	54	-8	1.40	14.0	NW
March.....	25.1	66	15	2.37	3.7	SW
April.....	40.2	80	34	7.01	10.1	SW
May.....	55.4	90	50	4.25	...	SW
June.....	70.4	90	58	5.00	...	SW
July.....	72.7	90	58	5.35	...	SW
August.....	68.0	90	38	3.00	...	SW
September.....	...	...	...	...	...	...
October.....	...	...	...	...	...	...
November.....	...	...	...	...	...	...
December.....	...	...	...	...	...	...
<b>Sums.....</b>	...	...	...	...	...	...
<b>Averages.....</b>	...	...	...	...	...	...
<b>RECAPITULATION BY SEASONS—</b>						
Winter months.....	...	...	...	...	...	...
Spring months.....	40.2	90	-8	13.73	...	S
Summer months.....	69.7	...	...	14.25	...	S
Autumn months.....	...	...	...	...	...	...

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT ELKADER, CLAYTON COUNTY.

BY CHAS. REINECKE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	12.5	41	-27	13	7.5	NW
February.....	31.2	67	-14	15	6.0	NW
March.....	43.1	81	22	30	...	NW
April.....	55.2	84	29	13	...	NW
May.....	70.6	94	46	22	...	NW
June.....	74.1	97	50	13	...	NW
July.....	87.4	98	30	33	...	NW
August.....	62.6	100	28	15	...	NW
September.....	51.6	85	16	23	...	NW
October.....	32.3	...	-8	23	6.0	NW
November.....	19.0	53	-17	35	6.0	NW
December.....	...	...	...	...	...	...
<b>Sums.....</b>	...	...	...	...	...	...
<b>Averages.....</b>	...	...	...	...	...	...
<b>RECAPITULATION BY SEASONS—</b>						
Winter months.....	...	...	...	...	...	...
Spring months.....	43.2	95	22	9.28	...	N
Summer months.....	70.7	98	50	6.68	...	N
Autumn months.....	48.8	100	-8	5.96	...	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
EMMETSBURG, PALO ALTO COUNTY.

BY H. CONROY, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	9.0	50	-17	0.30	8.0	
February.....	10.1	40	-28	2.50	25.0	
March.....						
April.....	41.2	80	19	4.49	7.0	NW
May.....	53.3	85	30	8.54		N
June.....	69.6	93	44	1.73		SE
July.....	72.8	97	51	3.56		SE
August.....	68.6	97	30	2.36		
September.....						
October.....	49.8	85	10	0.15		NW
November.....	30.1	76	-8	0.10	1.0	NW
December.....						
Sums.....						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....						
Spring months.....						
Summer months.....	70.8	97	30	7.65		S
Autumn months.....						

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
FAYETTE, FAYETTE COUNTY.

BY R. Z. LATIMER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipita- tion rain and melted snow— inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	5.2	39	-24	1.06	12.2	NW
February.....	13.0	88	-23	1.49	9.4	NW
March.....	29.4	89	-7	2.21	5.4	SW
April.....	42.7	78	19	8.73	6.0	NW
May.....	54.1	88	28	8.35		NW
June.....	69.8	93	40	3.45		SW
July.....	73.6	96	48	4.02		NW
August.....	69.2	99	35	2.04		SE
September.....	67.7	100	37	1.97		
October.....	50.5	83	15	8.19		SE
November.....	32.5	73	-9	1.40	6.0	NW
December.....						
Sums.....						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....						
Spring months.....	42.1	88	-7	9.29		NW
Summer months.....	70.8	99	40	10.11		SE & SW
Autumn months.....	60.2	100	-9	6.56		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
FORT MADISON, LEE COUNTY.

BY MISS L. A. M'CREADY, VOLUNTARY OBSERVER.

MONTHS.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	16.9	35	-12	1.66	9.5	SW
February.....	25.0	48	-10	1.39	12.5	NW
March.....	39.5	70	9	3.98	0.5	SE
April.....	52.4	89	15	4.88	.....	SW
May.....	62.6	90	43	4.85	.....	SW
June.....	75.6	92	60	2.35	.....	SW
July.....	79.3	95	65	2.15	.....	SW
August.....	74.3	95	62	1.88	.....	NE
September.....	60.2	93	40	4.88	.....	NE
October.....	57.4	84	28	0.35	.....	SW
November.....	38.8	68	8	2.20	3.5	NW
December.....	29.0	60	- 2	1.51	8.5	SW
Sums.....	.....	.....	.....	31.58	34.5	.....
Averages.....	51.7	95	-12	.....	.....	SW
RECAPITULATION BY SEASONS—						
Winter months.....	23.6	60	-12	4.56	.....	SW
Spring months.....	51.5	90	9	13.21	.....	SW
Summer months.....	76.4	95	65	6.38	.....	SW
Autumn months.....	55.1	93	8	7.43	.....	SW NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
FULTON, JACKSON COUNTY.

BY J. W. ECKLES, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	10.6	32	-26	1.80	14.5	.....
February.....	16.1	30	-25	1.05	8.0	.....
March.....	32.3	66	5	4.40	8.0	NE
April.....	46.4	82	30	3.50	.....	NE
May.....	.....	.....	.....	.....	.....	.....
June.....	.....	.....	.....	.....	.....	.....
July.....	.....	.....	.....	.....	.....	.....
August.....	68.9	.....	.....	1.75	.....	.....
September.....	64.9	96	30	1.14	.....	SE
October.....	52.2	82	16	0.12	.....	SW
November.....	32.8	72	0	1.25	10.0	SW
December.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	.....	.....	.....	.....	.....	.....
Spring months.....	.....	.....	.....	.....	.....	.....
Summer months.....	.....	.....	.....	.....	.....	.....
Autumn months.....	50.0	96	0	2.51	.....	S

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GALVA, IOWA COUNTY.

BY D. W. FARNSWORTH, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	12.6	42	-15	0.20	2.0	.....
February .....	14.4	50	-20	0.70	7.0	.....
March .....	44.1	80	20	2.20	4.5	.....
April .....	.....	.....	.....	.....	.....	.....
May .....	.....	.....	.....	.....	.....	.....
June .....	.....	.....	.....	.....	.....	.....
July .....	.....	.....	.....	.....	.....	.....
August .....	68.3	95	37	2.98	.....	SW
September .....	64.6	95	26	1.48	.....	SW
October .....	60.4	86	18	0.06	.....	.....
November .....	39.5	74	-4	.....	7.9	SW
December .....	18.3	48	-11	1.54	7.3	NW
Sums .....	.....	.....	.....	.....	.....	.....
Averages .....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months .....	15.1	48	-20	2.44	.....	.....
Spring months .....	.....	.....	.....	.....	.....	.....
Summer months .....	.....	.....	.....	.....	.....	.....
Autumn months .....	49.5	95	-4	.....	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GLENWOOD, MILLS COUNTY.

BY SETH DEAN, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipita- tion rain and melted snow—inches	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	18.2	54	-9	0.53	5.2	NW
February .....	22.1	60	-18	0.6	4.0	W & NW
March .....	37.0	84	2	5.7	8.0	NW
April .....	62.0	96	24	0.4	.....	NW & E
May .....	61.3	96	33	9.3	.....	N & S
June .....	.....	.....	.....	.....	.....	.....
July .....	.....	.....	.....	.....	.....	.....
August .....	73.6	99	42	8.5	.....	.....
September .....	71.4	102	34	3.5	.....	S
October .....	68.4	94	24	3.2	.....	S
November .....	40.0	86	2	2.3	.....	S
December .....	28.5	64	0	4.7	4.75	SW
Sums .....	.....	.....	.....	.....	.....	.....
Averages .....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months .....	22.2	64	-18	1.06	.....	NW
Spring months .....	60.4	96	2	7.64	.....	NW
Summer months .....	.....	.....	.....	.....	.....	.....
Autumn months .....	68.6	102	2	1.80	.....	■



# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT GRAND MEADOW, CLAYTON COUNTY.

BY F. L. WILLIAMS, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	5.1	28	-20	1.65	14.0	.....
February.....	14.4	40	-24	1.78	9.5	.....
March.....	28.9	.....	.....	2.29	7.2	.....
April.....	42.1	74	26	4.11	7.0	NE
May.....	54.7	80	36	3.18	.....	NW
June.....	68.8	92	54	3.80	.....	SE
July.....	72.0	90	56	5.72	.....	NW
August.....	66.8	90	42	1.70	.....	SW
September.....	61.1	86	31	2.01	.....	NW
October.....	50.4	80	22	3.02	.....	S NW
November.....	32.3	67	-8	1.34	8.2	S
December.....	20.0	51	-13	1.86	6.0	NW
Sums.....	.....	.....	.....	32.44	51.9	.....
Averages.....	43.0	92	-24	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	13.2	51	-24	5.27	.....	.....
Spring months.....	41.9	80	.....	9.58	.....	.....
Summer months.....	69.2	92	42	11.22	.....	SESW
Autumn months.....	47.9	86	-8	6.37	.....	NW S

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT GREENFIELD, ADAIR COUNTY.

J. G. CULVER, VOLUNTARY OBSERVER.

MONTHS.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	10.6	39	-17	0.45	5.5	NW
February.....	16.0	43	-21	1.37	8.4	S & NW
March.....	32.4	73	-2	1.96	3.2	.....
April.....	47.8	80	23	3.53	4.0	E
May.....	57.9	85	31	3.49	.....	NW
June.....	71.2	90	46	3.08	.....	S
July.....	75.6	96	52	2.95	.....	S
August.....	70.0	96	40	2.92	.....	NW
September.....	67.6	94	30	2.92	.....	S
October.....	53.2	86	21	0.23	.....	.....
November.....	36.0	75	-1	0.91	2.3	NW & SW
December.....	23.3	60	-10	1.86	15.4	NW
Sums.....	.....	.....	.....	25.67	38.8	.....
Averages.....	46.8	96	-21	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	16.6	60	-21	3.68	.....	NW
Spring months.....	46.0	85	-2	8.98	.....	.....
Summer months.....	72.3	96	40	8.95	.....	S
Autumn months.....	52.3	95	-1	4.06	.....	S & SW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GRINNELL, POWESHEIK COUNTY.

BY PROF. S. J. BUCK, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	8.7	33	-18	0.12	1.2	NW
February.....	17.9	40	-17	0.82	1.8	NW
March.....	32.5	67	4	1.80	1.2	E
April.....	44.8	74	25	8.35	0.8	SE
May.....	54.9	77	34	2.85	.....	N
June.....	.....	.....	.....	.....	.....	.....
July.....	.....	.....	.....	.....	.....	.....
August.....	.....	.....	.....	.....	.....	.....
September.....	62.1	.....	.....	2.33	.....	.....
October.....	55.1	85	22	1.56	.....	S
November.....	38.7	68	0	1.85	4.7	S
December.....	22.1	54	-10	2.62	8.0	NW
Sums.....	.....	.....	.....	.....	17.5	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	16.2	54	-17	8.56	.....	NW
Spring months.....	44.1	77	4	7.80	.....	E & SE
Summer months.....	.....	.....	.....	.....	.....	.....
Autumn months.....	52.0	85	.....	5.79	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
GRUNDY CENTER, GRUNDY COUNTY.

BY CHAS. G. ROGERS, VOLUNTARY OBSERVER.

				RECAPITULATION BY SEASONS—	Total snowfall.	Prevailing wind direction.
January.....	4.7	38	-16	0.50	1.3	NW
February.....	12.1	40	-22	1.12	7.0	NW
March.....	29.2	65	0	2.40	4.5	SSE
April.....	43.6	70	22	5.52	7.0	NW
May.....	55.2	82	34	2.71	.....	.....
June.....	71.5	.....	.....	3.07	.....	.....
July.....	74.3	92	54	2.22	.....	NW
August.....	63.2	96	38	1.56	.....	NW
September.....	62.5	94	26	1.50	.....	SE
October.....	50.7	85	18	2.22	.....	NWS
November.....	31.0	72	-9	1.11	3.0	NW
December.....	19.0	53	-11	0.98	3.8	NW
Sums.....	.....	.....	.....	24.91	29.6	.....
Averages.....	43.7	90	-22	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	11.9	53	-22	2.60	.....	NW
Spring months.....	42.7	82	0	10.63	.....	.....
Summer months.....	72.3	96	38	6.85	.....	NW
Autumn months.....	48.1	94	-9	4.83	.....	NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT HAMPTON, FRANKLIN COUNTY.

BY C. E. GRENELLE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	4.0	35	-19	0.82	7.0	NW
February.....	10.9	36	-23	2.91	15.4	NW
March.....	26.7	65	-4	2.56	3.4	NW
April.....	40.7	77	19	6.18	8.5	SE
May.....	53.6	83	29	2.94	.....	NW
June.....	69.3	93	45	3.75	.....	SE
July.....	73.2	96	50	4.36	.....	SW
August.....	68.3	96	37	1.15	.....	NW
September.....	62.2	94	24	1.54	.....	SE
October.....	50.3	84	13	1.63	.....	NW SW
November.....	30.8	73	-9	1.93	7.8	SW
December.....	13.7	61	-13	1.38	3.6	NW
Sums.....	.....	.....	.....	31.15	45.7	.....
Averages.....	42.2	96	-23	.....	.....	NW
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	10.5	51	-23	5.11	.....	NW
Spring months.....	40.3	83	-4	11.68	.....	NE NW
Summer months.....	70.3	96	37	9.26	.....	SE SW
Autumn months.....	47.8	94	-9	5.10	.....	SW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT HAWKEYE, FAYETTE COUNTY.

BY J. W. BOPP, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	.....	.....	.....	3.20	34.5	.....
February.....	.....	.....	.....	.....	.....	.....
March.....	.....	.....	.....	1.95	.....	.....
April.....	.....	.....	.....	4.79	20.0	.....
May.....	.....	.....	.....	3.18	.....	.....
June.....	.....	.....	.....	2.87	.....	.....
July.....	.....	.....	.....	1.68	.....	.....
August.....	.....	.....	.....	1.09	.....	.....
September.....	.....	.....	.....	.....	.....	.....
October.....	.....	.....	.....	.....	.....	.....
November.....	.....	.....	.....	.....	.....	.....
December.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	.....	.....	.....	.....
Spring months.....	.....	.....	.....	9.92	.....	.....
Summer months.....	.....	.....	.....	5.64	.....	.....
Autumn months.....	.....	.....	.....	.....	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
HOPEVILLE, CLARKE COUNTY.

BY MILTON T. ASHLEY, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	11.8	40	-15	0.17	2.0	NW
February.....	18.5	46	-16	0.50	4.0	NW
March.....	33.8	71	1	0.63	1.6	NW
April.....	57.4	83	33	3.35	.....	N
May.....	69.9	84	52	4.02	.....	SE
June.....	75.3	95	58	1.90	.....	SSW
July.....	70.0	92	46	3.40	.....	S
August.....	67.1	94	33	3.27	.....	SW
September.....	58.3	84	23	0.21	.....	S
October.....	.....	.....	.....	0.60	.....	.....
November.....	25.2	54	-5	0.63	2.6	NW
December.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	18.5	38	-16	1.20	.....	NW
Spring months.....	.....	63	1	.....	.....	NW
Summer months.....	71.7	95	45	9.41	.....	S
Autumn months.....	.....	94	.....	4.08	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
HOPKINTON, DELAWARE COUNTY.

BY THEODORE MARKS, VOLUNTARY OBSERVER.

MONTH.	TEMPERA				
	Mean.	Maximum.			
January.....	10.1	38	.....	.....	.....
February.....	18.0	44	.....	.....	.....
March.....	32.8	60	.....	.....	.....
April.....	46.0	70	.....	.....	.....
May.....	56.5	84	.....	.....	.....
June.....	.....	.....	.....	.....	.....
July.....	70.5	92	.....	.....	.....
August.....	71.0	92	.....	.....	.....
September.....	67.6	82	.....	.....	.....
October.....	55.2	71	.....	.....	.....
November.....	37.4	77	.....	.....	.....
December.....	23.3	56	.....	.....	.....
Sums.....	.....	.....	.....	40.8	.....
Average.....	.....	92	-17	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....
Winter months.....	17.4	52	-17	4.75	.....
Spring months.....	45.1	80	5	.....	.....
Summer months.....	.....	92	45	.....	.....
Autumn months.....	53.4	93	1	8.91	.....

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT HUMBOLDT, HUMBOLDT COUNTY.

BY HENRY S. WELLS, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....						
February.....						
March.....						
April.....						
May.....				8.29		
June.....				8.23		
July.....				4.90		
August.....				2.13		
September.....				0.92		
October.....				0.10		
November.....				0.31	4.0	
December.....				1.02		S SE
Sums.....						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....						
Spring months.....						
Summer months.....				10.81		S
Autumn months.....				1.33		S

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT INDEPENDENCE, BUCHANAN COUNTY.

BY E. F. WULFKE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	6.6	28	-21	1.1	1.0	W
February.....	13.3	40	-23		1.5	W
March.....	30.9	67	-2		1.8	SE
April.....	42.8		19		1.0	NW
May.....	54.8	84	28			SE
June.....	69.0	91	47			SE
July.....	73.9	96	51			W
August.....	67.9					
September.....	53.6	96	26			NW
October.....	53.1	83	18			NW
November.....	33.0	72	-10		1.5	NW SW
December.....	20.0	52	-14		1.2	W
Sums.....				21.10	44.7	
Averages.....	44.1	96	-23			W NW
RECAPITULATION BY SEASONS—						
Winter months.....	13.8	52	-23	3.40		W
Spring months.....	42.7	84	-2	6.22		E SE
Summer months.....	70.3	96	47	6.05		
Autumn months.....	50.2	93	-10	6.43		NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT INDIANOLA, WARREN, COUNTY.

BY PROF. J. L. TILTON, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	10.9	41	-14	0.34	5.0	NW
February.....	18.8	45	-17	0.90	2.0	NW
March.....	35.0	74	2	0.80	0.2	NW
April.....	47.7	80	22	5.05	2.0	NW
May.....	58.0	83	30	4.78	.....	SW
June.....	70.4	89	48	6.87	.....	SW
July.....	.....	.....	.....	.....	.....	.....
August.....	.....	.....	.....	.....	.....	.....
September.....	74.9	93	33	2.76	.....	SW
October.....	57.5	89	20	0.20	.....	SW
November.....	36.7	72	0	1.68	0.5	NW
December.....	23.3	59	-12	1.10	7.4	NW
Sums.....	.....	.....	.....	.....	17.1	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	17.7	59	-17	2.34	.....	NW
Spring months.....	46.9	83	2	10.63	.....	NW
Summer months.....	.....	.....	.....	.....	.....	.....
Autumn months.....	53.0	93	0	5.30	.....	SW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT IOWA CITY, JOHNSON COUNTY.

BY A. L. ARNER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	10.2	42	-20	1.18	9.6	NW
February.....	18.6	41	-18	1.75	5.2	NW
March.....	34.6	72	4	2.82	2.5	NW
April.....	48.5	88	24	4.37	2.5	NW
May.....	57.4	85	31	1.79	.....	NW
June.....	71.4	99	45	3.01	.....	NESE
July.....	75.4	95	55	3.56	.....	SW
August.....	70.3	94	45	1.64	.....	N
September.....	65.2	95	28	3.07	.....	SE
October.....	54.3	83	19	1.98	.....	SE
November.....	36.6	74	2	1.75	7.0	NW
December.....	25.3	60	-9	1.52	11.7	NW
Sums.....	.....	.....	.....	28.44	38.5	.....
Averages.....	47.4	99	-20	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	18.0	60	-20	4.45	.....	NW
Spring months.....	46.8	88	4	8.93	.....	NW
Summer months.....	72.4	99	45	8.21	.....	N & NE
Autumn months.....	52.0	95	2	6.80	.....	SE

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT IOWA FALLS, HARDIN COUNTY.

BY J. B. PARMELEE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	2.9	36	-21	0.52	4.0	NW
February... ..	11.4	37	-26	1.83	.....	.....
March.....	28.7	6	-6	2.22	6.0	NE S
April.....	40.5	76	20	4.45	5.0	NW
May.....	54.4	83	30	3.48	.....	E
June.....	69.4	89	45	2.79	.....	SE
July.....	72.3	92	51	3.24	.....	S
August... ..	67.8	97	37	0.95	.....	SSW
September.....	62.6	94	26	1.44	.....	SW
October.....	49.0	85	11	0.89	.....	NW
November.....	31.0	72	-7	1.37	3.5	NW
December.....	16.7	50	-14	1.50	.....	NW
Sums.. ..	.....	.....	.....	24.70	.....	.....
Averages. ....	42.0	97	-26	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months ..	10.3	50	-26	3.87	.....	NW
Spring months.....	40.5	83	-6	10.15	.....	NE E
Summer months.....	69.8	97	37	6.98	.....	S
Autumn months.....	47.5	94	-7	3.70	.....	NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT JEFFERSON, GREENE COUNTY.

BY CHARLES ENFIELD, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January. ....	16.8	40	-22	1.10	11.0	NW
February.....	30.8	73	-6	.....	.....	.....
March.....	47.0	80	17	.....	.....	E & NE
April.....	58.7	85	29	5.50	.....	NW
May.....	71.6	92	42	4.46	.....	SE
June.....	75.4	96	53	3.64	.....	S
July.....	69.2	96	37	1.76	.....	SE
August.....	66.0	95	24	1.58	.....	NW
September.....	55.1	85	20	0.45	.....	NW
October.....	38.5	70	-5	0.56	2.0	NW
November.....	21.7	55	-10	0.60	6.0	S
December.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	.....	55	-22	.....	.....	.....
Spring months.....	45.5	86	-6	.....	.....	E & NE
Summer months.....	72.1	96	37	9.86	.....	SE
Autumn months.....	52.5	95	-5	2.59	.....	NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT KEOKUK, LEE COUNTY.

BY FRED. Z. GOSEWISCH, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	14.3	45	-12	0.92	.....	NW
February.....	21.3	49	-12	1.76	.....	W
March .....	36.6	78	6	2.66	.....	W
April.....	49.9	85	27	3.41	.....	SE
May.....	59.8	85	39	4.36	.....	NW
June.....	73.0	92	54	2.37	.....	NW
July.....	78.0	93	61	2.60	.....	S
August.....	72.0	94	49	1.16	.....	N
September.....	69.5	97	37	3.18	.....	SW
October.....	57.0	90	27	0.33	.....	NW
November .....	39.0	74	7	2.29	4.7	NW
December.....	29.0	66	-6	0.90	7.8	NW
Sums. ....	.....	.....	.....	27.94	.....	.....
Averages.....	49.9	97	-12	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	21.5	66	-12	3.58	.....	NW
Spring months.....	48.8	85	6	12.43	.....	W NW
Summer months.....	74.3	94	40	6.13	.....	N NW
Autumn months.....	55.2	97	7	5.80	.....	NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT KEOSAUQUA, VAN BUREN COUNTY.

BY JNO. H. LANDES, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	14.4	43	-10	0.49	3.3	.....
February.....	22.0	45	-11	1.44	9.0	.....
March.....	36.8	71	6	2.35	T	N
April.....	49.9	86	25	4.82	.....	.....
May .....	59.4	89	36	4.48	.....	.....
June.....	72.9	95	49	2.72	.....	.....
July .....	78.2	97	55	1.94	.....	.....
August.....	72.2	97	43	2.26	.....	.....
September.....	68.5	98	34	5.40	.....	.....
October.....	57.1	89	23	1.08	.....	.....
November.....	38.2	74	7	1.24	2.8	.....
December.....	27.1	61	-5	0.80	10.5	.....
Sums... ..	.....	.....	.....	29.02	25.6	.....
Averages.....	49.7	98	-11	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months .....	21.2	61	-11	2.72	.....	.....
Spring months....	48.7	89	6	11.65	.....	.....
Summer months.....	74.4	97	43	6.92	.....	.....
Autumn months.....	54.6	98	7	7.72	.....	.....



# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT KNOXVILLE, MARION COUNTY.

BY CASEY AND REAVER, VOLUNTARY OBSERVERS.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....						
February.....						
March.....						
April.....						
May.....						
June..	72.5	91	51	4.63		SE
July.....	76.0	96	55	2.31		S
August.....	70.2	97	42	3.41		N
September.....	68.4	95	31	2.67		S
October.....	54.2	87	22	1.50		S & NW
November.....	34.9	71	2	0.97	2.0	S & NW
December.....	21.7	58	-8	1.90	17.5	NW
Sums..						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....						
Spring months.....						
Summer months...	72.9	97	42	10.35		S & SE
Autumn months.....	51.8	85	2	5.14		S & NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT LARRABEE, CHEROKEE COUNTY.

BY H. B. STREVER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January ..	9.0	39	-19	0.13	1.8	NNW
February.....	12.7	40	-23	0.79	8.4	NW
March.....	26.9	62	-7	2.47	9.3	
April.....	42.8	80	19	3.93	9.0	NE
May.....	55.8	87	32	4.11		
June.....	71.1	93	43	2.19		S
July.....	74.0	96	50	1.95		S
August.....	68.5	96	35	2.18		S
September.....	63.7	97	23	1.24		S
October.....	49.0	80	13	0.89		
November.....	31.9	74	-9	0.95	8.0	
December....	17.4	48	-14	2.27	5.7	
Sums.....				23.10	42.4	
Averages..	43.6	97	-23			
RECAPITULATION BY SEASONS—						
Winter months.....	13.0	48	-23	3.19		NW
Spring months.....	41.8	87	-7	10.51		
Summer months.....	71.2	96	35	6.32		S
Autumn months.....	48.2	97	-9	3.08		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
LOGAN, HARRISON COUNTY.

BY M. B. STERN, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	14.8	40	-12	0.40	4.0	N
February .....	17.4	49	-16	1.56	15.0	N
March .....	31.1	73	0	0.84	8.0	N
April .....	47.3	88	20	2.10	.....	NW
May .....	58.6	88	32	4.73	.....	SW
June .....	71.8	93	50	3.97	.....	SW
July .....	74.8	97	53	3.62	.....	SW
August .....	70.0	94	37	1.99	.....	SW
September .....	66.8	95	31	1.35	.....	SW
October .....	55.9	88	22	0.15	1.0	SW
November .....	35.0	22	0	0.53	6.0	SW
December .....	23.5	60	-11	1.22	8.0	S & SW
Sums .....	.....	.....	.....	22.40	37.0	.....
Averages .....	47.2	97	-16	.....	.....	S
RECAPITULATION BY SEASONS—						
Winter months .....	18.6	60	-16	3.12	.....	S
Spring months .....	45.6	88	0	7.67	.....	N & NW
Summer months .....	72.2	97	37	9.58	.....	S
Autumn months .....	52.6	95	0	2.03	.....	S

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MAQUOKETA, JACKSON COUNTY.

BY A. B. BOWEN, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	7.2	.....	.....	0.44	24.0	.....
February .....	16.0	39	-19	1.73	6.0	.....
March .....	31.8	66	3	3.17	.....	.....
April .....	45.8	.....	.....	4.30	.....	.....
May .....	57.4	.....	.....	1.77	.....	.....
June .....	.....	.....	.....	.....	.....	.....
July .....	75.0	95	68	2.07	.....	.....
August .....	69.3	96	52	1.62	.....	.....
September .....	62.3	92	32	3.22	.....	.....
October .....	47.7	82	18	0.78	.....	.....
November .....	33.3	72	0	1.21	5.0	.....
December .....	23.6	60	-8	1.10	4.5	.....
Sums .....	.....	.....	.....	.....	.....	.....
Averages .....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months .....	15.6	60	.....	3.68	.....	.....
Spring months .....	45.0	.....	.....	9.24	.....	.....
Summer months .....	.....	.....	.....	.....	.....	.....
Autumn months .....	47.8	92	0	5.21	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MARSHALLTOWN, MARSHALL COUNTY.

BY L. S. KILBORN, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	10.1	28	-14	0.44	4.5	N
February.....	14	30	-17	0.02	2.8	N
March.....	20	39	1	1.97	2.2	N
April.....	28	39	9	3.06	1.5	N
May.....	31	38	25	2.10		N
June.....	37	49	25	4.64		N
July.....	32	50	22	2.66		N
August.....	32	43	22	2.43		N
September.....	30	33	17	1.73		N
October.....	35	36	16	0.62		N
November.....						
December.....						
Sums.....						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....						
Spring months.....		31	1	9.06		S
Summer months.....		32	43	9.73		S
Autumn months.....						

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MAXON, MONROE COUNTY.

BY GUS JOHNSON, VOLUNTARY OBSERVER.

MONTHS.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	9.1	35	-13	0.25	2.5	
February.....	17.5	42	-15	1.00	2.0	
March.....	32.8	75	0	2.56	0.5	
April.....	46.6	80	25	4.53		
May.....	57.7	85	38	3.38		
June.....	72.5	93	54	5.88		
July.....	77.8	96	64	2.62		
August.....	71.6	98	50	3.42		
September.....	64.7	96	34	3.11		
October.....	53.7	80	23	1.92		
November.....	53.8	72	-5	1.23	0.5	
December.....	23.4	56	-9	1.25	8.5	
Sums.....				31.50	14.0	
Averages.....	43.9	96	-16			
RECAPITULATION BY SEASONS—						
Winter months.....	16.7	58	-16	2.50		
Spring months.....	45.6	85	0	10.57		
Summer months.....	74.0	96	50	12.12		
Winter months.....	51.4	96	-5	6.31		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MECHANICSVILLE, CEDAR COUNTY.

BY JOSEPH W. HUBBARD, VOLUNTARY OBSERVER.

Sums .....	45.1	84	-18	28.24	
Averages .....	45.1	84	-18		
RECAPITULATION BY SEASONS—					
Winter months .....	14.6		-18	3.83	
Spring months.....	46.3		2	10.18	E NE
Summer months.....	70.7		42	8.83	NW
Autumn months.....	48.9		-1	6.09	S NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MONTICELLO, JONES COUNTY.

BY HENRY D. SMITH, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	5.6	21	22	1.16	6.0	NW
February...	14.6	23	23	1.32	4.2	NW
March.....	20.4	4	4	2.44	6.0	NW
April.....	43.6	11	11	8.58	4.0	NW
May.....	54.8	23	23	2.57		NW
June.....	70.4	19	19	5.82		SE
July.....	74.0	30	30	1.92		NW
August.....	68.2	29	29	1.23		NW
September.....	62.6	28	28	2.50		NW
October.....	49.8	16	16	2.08		S & NW
November ..	31.5	6	6	1.80	10.6	NW
December.....	19.9	16	16	1.54	5.3	NW
Sums .....				27.98	20.0	
Averages....	43.7		22			NW
RECAPITULATION BY SEASONS—						
Winter months.....	13.4	23	23	4.04		NW
Spring months.....	42.6	4	4	8.50		NW
Summer months.....	70.9	30	30	8.97		NW
Autumn months.....	47.9	5	5	6.38		NW

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT MT. AYR, RINGGOLD COUNTY.

BY W. M. SHRIVER, VOLUNTARY OBSERVER.

MONTHS.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	16.4	48	-12	0.16	1.5	...
February .....	20.9	48	-16	0.95	4.0	SW
March .....	34.8	73	8	2.13	10.0	NE
April .....	49.3	83	20	3.31	...	...
May .....	59.0	87	33	5.00	...	...
June .....	71.9	91	50	4.14	...	...
July .....	76.8	93	56	4.75	...	...
August .....	73.0	94	43	3.96	...	...
September .....	71.3	93	47	1.49	...	...
October .....	...	...	...	0.63	...	NW
November .....	...	...	...	...	...	...
December .....	38.9	...	...	0.50	4.5	SW
Sums .....	...	...	...	...	...	...
Averages .....	...	...	...	...	...	...
RECAPITULATION BY SEASONS—						
Winter months .....	23.1	...	-13	1.70	...	...
Spring months .....	47.7	87	3	10.53	...	...
Summer months .....	73.6	94	43	12.87	...	...
Autumn months .....	...	...	...	...	...	...

# ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT MT. VERNON, LINN COUNTY.

BY PROF. A. COLLIN, VOLUNTARY OBSERVER.

						Prevailing wind direction.
January .....	7.0	36	-20	...	...	...
February .....	17.4	44	-13	...	...	...
March .....	32.7	66	1	...	...	...
April .....	47.0	82	23	...	...	...
May .....	57.9	84	36	2.35	...	...
June .....	72.9	94	54	4.30	...	...
July .....	77.4	95	60	2.60	...	...
August .....	...	...	...	...	...	...
September .....	65.9	92	33	3.70	...	...
October .....	61.1	79	22	4.12	...	...
November .....	34.3	71	-4	...	...	...
December .....	22.4	55	-11	...	...	...
Sums .....	...	...	...	...	...	...
Averages .....	...	...	...	...	...	...
RECAPITULATION BY SEASONS—						
Winter months .....	15.9	58	-20	...	...	...
Spring months .....	45.9	84	1	...	...	...
Summer months .....	...	...	...	...	...	...
Autumn months .....	61.1	92	-4	...	...	...

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
MURRAY, CLARKE COUNTY.

BY A. W. LEWIS, VOLUNTARY OBSERVER.

	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	10.9	38	-13	0.23	2.3	N
February.....	18.4	47	-16	0.60	3.8	S
March.....	33.7	72	1	0.94	1.4	NW
April.....	46.4	77	23	4.70	3.0	.....
May.....	56.8	85	32	4.44	.....	NW
June.....	70.4	83	49	5.37	.....	S SE
July.....	.....	.....	.....	1.60	.....	.....
August.....	.....	.....	.....	5.73	.....	.....
September.....	.....	.....	.....	3.87	.....	.....
October.....	.....	.....	.....	0.05	.....	.....
November.....	.....	.....	.....	.....	.....	.....
December.....	.....	.....	.....	.....	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	.....	.....	.....	.....	.....	.....
Spring months.....	45.6	85	1	10.08	.....	.....
Summer months.....	.....	.....	.....	12.70	.....	.....
Autumn months.....	.....	.....	.....	.....	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
NEWTON, JASPER COUNTY.

BY ALBERT LUBKIN, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	9.0	40	-17	0.67	9.8	N
February.....	16.9	41	-16	1.00	6.8	NW
March.....	33.5	73	1	1.53	3.1	E
April.....	46.3	62	21	5.41	6.0	W
May.....	57.4	84	33	2.92	.....	NW
June.....	72.0	93	48	3.65	.....	NW
July.....	74.6	95	55	5.24	.....	NW
August.....	70.0	95	43	3.35	.....	NW SE
September.....	64.6	93	30	2.11	.....	NW
October.....	53.2	87	18	1.17	.....	.....
November.....	34.3	71	-5	1.43	6.5	S NW
December.....	21.4	56	-11	1.11	12.0	NW
Sums.....	.....	.....	.....	29.39	44.2	.....
Averages.....	46.1	95	-19	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	15.8	56	-19	2.78	.....	NW
Spring months.....	45.7	84	1	9.66	.....	W NW
Summer months.....	72.2	95	43	12.24	.....	NW
Autumn months.....	50.7	93	-5	4.71	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
OMAHA, DOUGLAS COUNTY, NEBRASKA.

BY GEO. E. HUNT, LOCAL FORECAST OFFICIAL.

MONTHS.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	15.9	47	- 8	0.24	.....	NW
February.....	20.0	52	-16	0.97	.....	N
March.....	34.0	73	4	1.20	.....	NW
April.....	48.0	82	25	3.12	.....	NW
May.....	59.0	86	36	3.74	.....	NE
June.....	73.0	90	53	7.11	.....	SE
July.....	77.5	97	60	3.03	.....	SE
August.....	71.0	94	45	3.32	.....	SE
September.....	68.0	93	34	1.73	.....	SE
October.....	55.4	89	24	0.12	.....	NW
November.....	37.0	72	0	0.43	.....	NW
December.....	27.0	60	- 5	1.13	8.0	NW
Sums.....	.....	.....	.....	28.68	.....	.....
Averages.....	48.8	97	-16	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	21.0	60	-16	2.38	.....	NW
Spring months.....	47.0	86	4	8.25	.....	NW
Summer months.....	73.8	97	53	13.76	.....	SE
Autumn months.....	53.5	93	0	2.27	.....	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
OSAGE, MITCHELL COUNTY.

BY G. D. PATTENGILL, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	2.6	.....	.....	0.85	9.0	NW
February.....	9.7	.....	.....	2.33	14.8	NW
March.....	23.8	.....	.....	2.46	7.0	SE
April.....	38.6	.....	.....	3.14	22.0	NW
May.....	52.6	.....	.....	3.83	.....	NW
June.....	66.1	.....	.....	2.28	.....	.....
July.....	71.3	.....	.....	4.08	.....	.....
August.....	64.4	.....	.....	2.57	.....	.....
September.....	58.0	.....	.....	1.81	.....	.....
October.....	46.2	.....	.....	1.69	.....	.....
November.....	27.3	.....	.....	0.73	5.5	.....
December.....	16.1	.....	.....	1.65	6.0	.....
Sums.....	.....	.....	.....	29.44	64.3	.....
Averages.....	39.7	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	9.5	.....	.....	4.63	.....	.....
Spring months.....	38.3	.....	.....	11.45	.....	.....
Summer months.....	67.3	.....	.....	8.93	.....	.....
Autumn months.....	43.8	.....	.....	4.23	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
OSKALOOSA, MAHASKA COUNTY.

BY JOS. BOYD, VOLUNTARY ORSERVER.

	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevalling wind direction.
	Mean.	Maximum.	Minimum.			
January.. .. .	10.5	40	-21	0.59	5.4	NW
February.. .. .	18.7	42	-16	1.12	2.2	NW
March. .... .	34.0	74	4	1.90	1.8	SW
April.. .. .	47.1	85	22	3.39	2.0	NW
May .... .	57.1	84	31	2.70		NW
June..... .	70.6	91	48	4.87		
July..... .	75.5	96	52	1.49		SW
August..... .	70.1	99	36	1.69		SSE
September .....	65.8	97	29	2.37		SW
October .... .	53.5	88	20	1.20		SE
November..... .	35.9	73	0	1.24		NW
December..... .	23.9	59	-9	0.93	8 6	NW
Sums... ..				23.49		
Averages..... .	46.9	99	-21			NW
RECAPITULATION BY SEASONS—						
Winter months .....	17.7	59	-21	2.64		NW
Spring months..... .	46.1	85	4	7.99		NW
Summer months..... .	72.1	99	39	8 05		
Autumn months... ..	51.7	97	0	4.81		NW SW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
OVID, WAYNE COUNTY.

BY H. C. MILLER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevalling wind direction.
	Mean.	Maximum.	Minimum.			
January.. .. .						
February..... .						
March..... .						
April..... .						
May..... .	60.3	85	40	3.23		
June. .... .	70.0	93	48	4.31		
July..... .	76.0	94	54	2.40		
August..... .	70.9	96	42	3.53		
September..... .	67.6	94	32	3.30		
October..... .	53.2	88	23	1.32		
November... ..	36.8	72	1	1.16	1.0	NW
December .....	25.2	62	-6	1.22	9.0	NW SW
Sums..... .						
Averages..... .						
RECAPITULATION BY SEASONS—						
Winter months .....						
Spring months..... .						
Summer months..... .	72.3	96	42	10.24		
Autumn months..... .	52.2	94	1	5.78		



## ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
PANAMA, SHELBY COUNTY.

BY WM. J. WICKS, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	12.2	41	-13	0.29	2.9	NW
February.....	15.9	42	-18	1.16	10.5	NW
March.....	30.3	70	-2	1.10	0.7	NW
April.....	45.6	81	21	2.47	2.9	NW
May.....	56.7	82	33	5.17	.....	SE NW
June.....	69.6	88	45	4.44	.....	S
July.....	74.3	96	51	3.98	.....	S
August.....	68.4	94	40	2.32	.....	SW
September.....	66.0	93	29	1.35	.....	SE
October.....	53.1	89	21	0.12	.....	SW
November.....	35.0	72	-4	0.46	2.9	SW
December.....	22.1	55	-11	1.26	5.6	SE
Sums.....	.....	.....	.....	24.12	25.7	.....
Averages.....	45.8	96	-18	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	16.7	55	-18	2.71	.....	NW
Spring months.....	44.3	82	-2	8.74	.....	NW
Summer months.....	70.8	96	40	10.74	.....	S
Autumn months.....	51.4	93	-4	1.93	.....	SW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
RICHLAND, KEOKUK COUNTY.

BY W. A. SHAFFER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	8.6	40	-20	0.92	9.0	.....
February.....	18.2	40	-19	1.15	1.8	.....
March.....	32.3	70	2	3.03	0.8	.....
April.....	47.0	85	27	4.63	6.0	.....
May.....	58.4	91	35	3.24	.....	.....
June.....	71.4	100	53	6.53	.....	.....
July.....	76.1	99	62	2.21	.....	.....
August.....	70.1	100	43	1.91	.....	.....
September.....	65.5	98	38	5.30	.....	.....
October.....	53.8	88	23	1.64	.....	.....
November.....	33.5	78	0	1.96	4.5	.....
December.....	22.4	58	-11	1.29	14.7	.....
Sums.....	.....	.....	.....	30.81	36.8	.....
Averages.....	46.4	100	-20	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	16.4	58	-20	3.36	.....	.....
Spring months.....	45.9	91	2	10.90	.....	.....
Summer months.....	72.5	100	43	7.65	.....	.....
Autumn months.....	50.9	98	0	8.90	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
ROCK RAPIDS, LYON COUNTY.

BY W. C. WYCKOFF, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	.....	.....	.....	.....	.....	.....
February.....	.....	.....	.....	.....	.....	.....
March.....	.....	.....	.....	.....	.....	.....
April.....	.....	.....	.....	.....	.....	.....
May.....	56.2	86	32	4.69	.....	.....
June.....	70.8	95	43	1.36	.....	.....
July.....	74.8	99	48	4.91	.....	.....
August.....	68.2	91	34	1.24	.....	.....
September.....	61.8	98	18	0.74	.....	.....
October.....	47.5	80	15	1.05	.....	.....
November.....	31.6	72	-6	0.30	3.0	.....
December.....	17.7	42	-16	1.15	4.0	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages... ..	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	.....	.....	.....	.....	.....	.....
Spring months....	.....	.....	.....	.....	.....	.....
Summer months.....	71.3	99	34	7.51	.....	.....
Autumn months.....	47.0	98	-6	2.09	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
SAC CITY, SAC COUNTY.

BY DR. CALEB BROWN, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	7.8	38	-14	0.14	1.5	NW
February.....	11.3	40	-21	1.20	14.0	NW
March.....	27.6	65	-3	1.75	5.0	NE SE
April.....	42.0	66	22	2.60	.....	NE SE
May.....	51.4	80	33	2.25	.....	SW
June.....	71.2	89	34	5.20	.....	SE SW
July.....	74.5	93	54	2.12	.....	SW
August.....	64.2	95	30	2.05	.....	SW
September.....	.....	.....	.....	.....	.....	.....
October.....	.....	.....	.....	.....	.....	.....
November.....	.....	.....	.....	.....	.....	.....
December.....	18.7	57	-10	1.65	8.0	NW SW
Sums.....	.....	.....	.....	.....	.....	.....
Averages... ..	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months.....	12.6	57	-21	3.99	.....	NW
Spring months.....	40.3	80	-3	6.60	.....	NE SE
Summer months.....	70.0	95	54	9.87	.....	SW
Autumn months.....	.....	.....	.....	.....	.....	.....

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ANNUAL REPORT OF THE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
SEYMOUR, WAYNE COUNTY.

BY MRS. C. A. CONGER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....						
February.....						
March.....						
April.....	49.2	87	24	5.37	1.9	
May.....	56.2	85	32	8.70		NE
June.....	70.8	95	47	5.06		S
July.....	76.5	96	55	2.75		S
August.....	70.2	98	42	4.67		S
September.....	66.1	95	30	5.49		S
October.....	53.7	87	15	1.20		S
November.....						
December.....	27.6	60	-10	1.67	14.5	NW
Sums., .....						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....						
Spring months.....						
Summer months.....	72.5	93	42	12.48		S
Autumn months.....						

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
SIBLEY, OSCEOLA COUNTY.

BY H. G. DOOLITTLE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipita- tion rain and melted snow— inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....						
February.....						
March.....						
April.....						
May.....	55.2	82	28	1.61		NW
June.....	69.1	90	40	2.41		S
July.....	69.3	92	47	3.37		S
August.....	66.4	92	35	2.26		SE
September.....	60.9	93	18	0.88		NW
October.....						
November.....	30.4	74	-9	0.17	2.5	SW
December.....	16.2	44	-21	1.43	4.5	NW
Sums.. .....						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....						
Spring months.....						
Summer months.....	68.3	92	47	7.94		S
Autumn months.....						

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
SIOUX CITY, WOODBURY COUNTY.

BY U. G. PURSELL, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	12.8	46	-11	0.34	.....	N
February.....	18.2	45	-21	0.77	.....	N
March.....	29.1	67	4	1.43	.....	NW
April.....	44.5	83	21	2.51	.....	NW
May.....	57.0	87	37	3.17	.....	NW
June.....	72.0	92	46	2.41	.....	NW
July.....	75.0	97	53	2.29	.....	NW
August.....	70.0	94	42	5.25	.....	SE
September.....	66.0	85	29	1.11	.....	SE
October.....	51.0	68	21	0.58	.....	NW
November.....	34.0	73	-4	0.75	.....	NW
December.....	20.0	49	-6	1.57	.....	NW
<b>Sums.....</b>				<b>23.83</b>		
<b>Averages.....</b>	<b>45.5</b>	<b>97</b>	<b>-21</b>			<b>NW</b>
<b>RECAPITULATION BY SEASONS—</b>						
Winter months.....	15.9	49	-21	2.08	.....	N
Spring months.....	43.6	87	4	8.16	.....	NW
Summer months.....	72.8	97	42	10.53	.....	S
Autumn months.....	50.3	85	-4	2.44	.....	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
STORM LAKE, BUENA VISTA COUNTY.

BY A. J. BOND, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	11.1	37	-10	0.17	1.8	NW
February.....	13.9	39	-21	1.48	16.7	NW
March.....	27.4	59	-5	2.60	5.0	NW SE
April.....	42.9	78	20	2.72	11.1	NW
May.....	56.8	82	33	3.41	.....	SE
June.....	72.4	92	53	3.34	.....	S
July.....	74.9	95	57	2.99	.....	SW
August.....	71.0	94	44	1.90	.....	SW
September.....	66.7	92	27	0.90	.....	SE
October.....	51.7	81	17	0.10	.....	S NW
November.....	33.8	73	-3	1.03	6.7	NW
December.....	18.6	46	-10	1.46	6.6	SE NW
<b>Sums.....</b>				<b>10</b>	<b>46.9</b>	
<b>Averages.....</b>	<b>45.0</b>					<b>NW</b>
<b>RECAPITULATION BY SEASONS—</b>						
Winter months.....	14.5			11	.....	NW
Spring months.....	42.3			7.3	.....	NW
Summer months.....	72.8			23	.....	SW
Autumn months.....	50.7			06	.....	NW

ANNUAL REPORT OF THE  
ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
TIPTON, CEDAR COUNTY.

BY J. M. RIDER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January...	9.3	43	-18	0.79	14.0	NW
February...	16.8	40	-18	2.30	2.2	W
March...	33.8	77	2	3.77	4.0	NW
April...	45.3	86	23	4.63	3.7	NW
May...	57.5	87	34	2.93	.....	NE&NW
June...	71.4	93	48	2.18	.....	S
July...	75.9	97	55	1.69	.....	NW
August...	.....	.....	.....	.....	.....	.....
September...	64.8	97	32	3.39	.....	NW
October...	48.7	80	21	1.71	.....	.....
November..	34.8	70	0	2.00	10.0	W
December...	23.6	58	-10	1.39	13.5	NW
Sums.....	.....	.....	.....	.....	47.4	.....
Averages.....	.....	.....	.....	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	16.6	58	-18	4.48	.....	NW
Spring months.....	45.5	87	2	11.38	.....	NW
Summer months.....	.....	.....	.....	.....	.....	.....
Autumn months.....	49.4	97	0	7.10	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
VILLISCA, MONTGOMERY COUNTY.

BY J. S. BOISE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	18.0	44	-9	0.22	2.0	NW
February.....	21.5	55	-16	0.21	2.1	NW
March.....	33.5	70	2	3.09	17.3	SE
April.....	49.6	82	24	1.24	0.3	NW
May.....	59.7	85	34	2.96	.....	NW
June.....	72.9	90	50	3.80	.....	SW
July.....	78.1	95	60	6.75	.....	SW
August.....	70.1	91	42	6.32	.....	SW
September.....	63.2	88	32	1.99	.....	.....
October..	53.2	80	10	0.24	.....	.....
November.....	38.4	70	-3	.....	0.5	.....
December.....	24.2	58	0	0.46	.....	.....
Sums.....	.....	.....	.....	.....	.....	.....
Averages.....	48.5	95	-16	.....	.....	.....
RECAPITULATION BY SEASONS—						
Winter months.....	21.2	56	-16	0.89	.....	NW
Spring months.....	47.6	85	2	7.29	.....	NW
Summer months.....	73.7	95	42	15.87	.....	SW
Autumn months.....	51.6	88	-3	.....	.....	.....

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
VINTON, BENTON COUNTY.

BY T. F. M'CUNE, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	6.6	31	-17	0.86	10.0	NW
February.....	15.9	87	-17	0.49	1.5	.....
March.....	31.2	69	1	1.65	1.5	NW
April.....	44.4	77	25	3.22	10.0	NW
May.....	55.8	82	35	2.60	.....	NW
June.....	70.4	89	53	3.19	.....	SE
July.....	74.5	94	49	1.65	.....	NW
August.....	69.1	94	41	1.40	.....	NW
September.....	63.3	94	29	1.85	.....	NW
October.....	51.3	81	20	2.57	.....	SE NW
November.....	32.7	.....	.....	0.81	4.0	SW NW
December.....	21.0	52	-8	0.64	5.0	NW
Sums.....	.....	.....	.....	20.93	32.0	.....
Averages.....	44.7	94	-17	.....	.....	NW
RECAPITULATION BY SEASONS—						
Winter months.....	14.5	52	-17	1.99	.....	NW
Spring months.....	43.8	82	1	7.47	.....	NW
Summer months.....	71.3	94	41	6.24	.....	NW
Autumn months.....	48.8	94	.....	5.23	.....	NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WASHINGTON, WASHINGTON COUNTY.

BY WM. A. COOK, VOLUNTARY OBSERVER.

MONTHS.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January.....	11.9	40	-14	0.89	5.0	NW
February.....	20.6	48	-15	0.30	.....	W
March.....	36.6	75	6	2.70	2.0	SW NW
April.....	49.5	84	32	4.21	4.0	NE
May.....	59.9	92	35	1.74	.....	NE
June.....	76.5	100	50	3.83	.....	SW
July.....	81.5	100	56	2.27	.....	SW
August.....	74.4	98	47	1.65	.....	NE
September.....	68.4	90	38	4.24	.....	SW NE
October.....	54.9	88	23	1.15	.....	NW SW
November.....	36.6	.....	.....	0.90	4.0	SW
December.....	25.9	62	-7	1.14	.....	SW
Sums.....	.....	.....	.....	25.02	.....	.....
Averages.....	49.7	100	-15	.....	.....	SW
RECAPITULATION BY SEASONS—						
Winter months.....	19.5	62	-15	2.33	.....	SW NW
Spring months.....	48.7	92	6	8.65	.....	NE
Summer months.....	77.5	100	47	7.75	.....	SW
Autumn months.....	53.3	90	.....	6.29	.....	SW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
WEBSTER CITY, HAMILTON COUNTY.

BY C. M. TRUMBAUER, VOLUNTARY OBSERVER.

				Total precipitation rain and melted snow—Inches.	Total snowfall.	Prevailing wind direction.
January.....	8.6	87	-18	0.73	.2	NW
February.....	13.3	40	-26	1.79	.4	NW
March.....	28.2	72	-4	1.18	.5	SE
April.....	41.1	78	26	4.12	.6	NE SE
May.....	54.7	86	33	3.62	..	NW
June.....	70.5	98	56	2.76	..	SW
July.....	75.3	96	60	3.90	..	SE
August.....	68.7	90	40	2.90	..	SE
September.....	65.4	94	30	1.00	..	SE
October.....	50.3	86	22	0.50	..	SE NW
November.....	31.0	74	-3	1.40	.8	NW
December.....	21.0	62	-9	1.04	.2	SE
Sums.....				24.94	21.9	
Averages.....	44.0	90	-26			SE
RECAPITULATION BY SEASONS—						
Winter months.....	14.3	52	-26	3.56		NW
Spring months.....	41.3	86	-4	8.92		SE
Summer months.....	71.5	96	40	6.56		SE
Autumn months.....	48.9	94	-3	2.90		SE NW

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS, AT  
WEST BEND, PALO ALTO COUNTY.

BY PHIL DORWEILER, VOLUNTARY OBSERVER.

Sums.....						
Averages.....						
RECAPITULATION BY SEASONS—						
Winter months.....						
Spring months.....						
Summer months.....						
Autumn months.....	46.6	96	-9	2.72		

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WILLIAMS, HAMILTON, COUNTY.

BY M. L. FULLER, VOLUNTARY OBSERVER.

MONTH.	TEMPERATURE.			Total precipitation rain and melted snow—Inches.	Total snowfall	Prevailing wind direction.
	Mean.	Maximum.	Minimum.			
January .....	5.1	34	-20	0.33	3.8	NW
February .....	12.6	30	-24	2.20	9.3	NW
March .....	27.4	45	-5	1.89	1.3	SE
April .....	41.6	75	20	5.00	4.0	NW
May .....	54.3	83	36	3.68	.....	NW&E
June .....	66.7	92	52	3.01	.....	S
July .....	72.6	93	57	5.93	.....	S
August .....	68.4	.....	.....	1.70	.....	S
September .....	61.4	94	25	1.49	.....	SE
October .....	49.7	84	11	1.06	.....	S
November .....	30.2	73	-9	1.57	5.4	SW
December .....	16.3	51	-20	0.96	2.0	NW
Sums .....	.....	.....	.....	28.91	25.4	.....
Averages .....	42.6	.....	-24	.....	.....	NW
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months .....	12.0	51	-24	3.49	.....	NW
Spring months .....	41.1	83	-5	10.67	.....	NW&E
Summer months .....	69.9	.....	.....	10.73	.....	S
Autumn months .....	47.1	94	-9	4.12	.....	S&SE

ANNUAL SUMMARY OF METEOROLOGICAL OBSERVATIONS AT  
WINTERSET, MADISON COUNTY.

BY WILL M'KNIGHT, VOLUNTARY OBSERVER.

January .....	11.8	42	-16	0.62	5.2	NW
February .....	17.4	44	-18	0.94	4.5	SW NW
March .....	23.2	75	0	1.86	0.5	S
April .....	48.3	82	19	5.65	4.0	NW
May .....	59.0	87	32	3.16	.....	W
June .....	70.8	92	50	5.96	.....	S
July .....	76.5	96	54	2.00	.....	SW
August .....	70.8	100	43	2.91	.....	NW
September .....	66.2	96	31	2.72	.....	S
October .....	54.8	86	22	0.15	.....	S
November .....	.....	.....	.....	.....	.....	.....
December .....	25.0	58	-9	1.25	12.5	NW
Sums .....	.....	.....	.....	.....	.....	.....
Averages .....	.....	100	-18	.....	.....	.....
RECAPITULATION BY SEASONS—	.....	.....	.....	.....	.....	.....
Winter months .....	16.1	58	-18	2.71	.....	NW
Spring months .....	46.6	87	0	10.66	.....	W & NW
Summer months .....	72.4	100	43	10.77	.....	SW NW
Autumn months .....	.....	96	.....	.....	.....	.....



## MONTHLY AND ANNUAL PRECIPITATION FOR STORM LAKE, IA.

A. J. BOND, OBSERVER.

The greatest annual precipitation was 40.82 inches in 1891.  
 The least annual precipitation was 17.30 inches in 1880.  
 The greatest monthly precipitation was 14.70 inches in June, 1891.  
 The least monthly precipitation was 0.03 inches in January, 1881.

## NORMAL TEMPERATURE—DUBUQUE, IOWA.

DAY OF MONTH.	*January.	†February.	†March.	†April.	*May.	*June.	*July.	*August.	*September.	*October.	*November.	*December.
1	20	19	30	40	52	64	72	73	63	50	45	29
2	14	22	29	41	52	64					43	29
3	13	21	27	42	53	63					41	31
4	17	20	26	42	52	64					43	31
5	18	21	29	43	54	66					42	31
6	17	23	29	46	56	65					43	29
7	16	24	27	45	57	66					41	26
8			30	47	60	67					42	25
9			33	50	60	66					41	27
10			33	46	60	66					42	23
11			34	47	59	65					42	27
12			33	49	59	70					40	28
13			32	50	58	70					38	29
14			30	51	59	71					36	26
15			31	48	59	71					36	26
16			30	47	59	72					36	23
17			31	50	61	71					34	20
18			33	53	62	70					32	13
19			34	53	63	70					33	11
20			33	52	62	70					34	26
21			32	53	62	71					32	26
22			34	56	62	70					32	26
23			35	54	63	72					30	26
24			37	50	66	73					26	25
25			37	52	64	73					29	23
26			37	55	62	73					29	25
27			42	56	64	72					30	19
28			37	54	61	73					27	21
29			36	51	65	72					24	21
30			39	51	66	73					26	22
31			41	--	63	--					--	23
Means..		3	33	49	60	69				1	36	24

\*Eighteen years. †Twenty years.

NORMAL PRECIPITATION—DUBUQUE, IOWA.

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\*Twenty-one years. Computed from twenty and twenty-one years observations from July, 1872, to December 31, 1892.

ANNUAL REPORT OF THE  
MONTHLY STATEMENT OF AVERAGES—DUBUQUE, IOWA.

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S. C. EMERY, OBSERVER.

## METEOROLOGICAL DATA—DUBUQUE, IOWA.

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S. C. EMERY, OBSERVER.

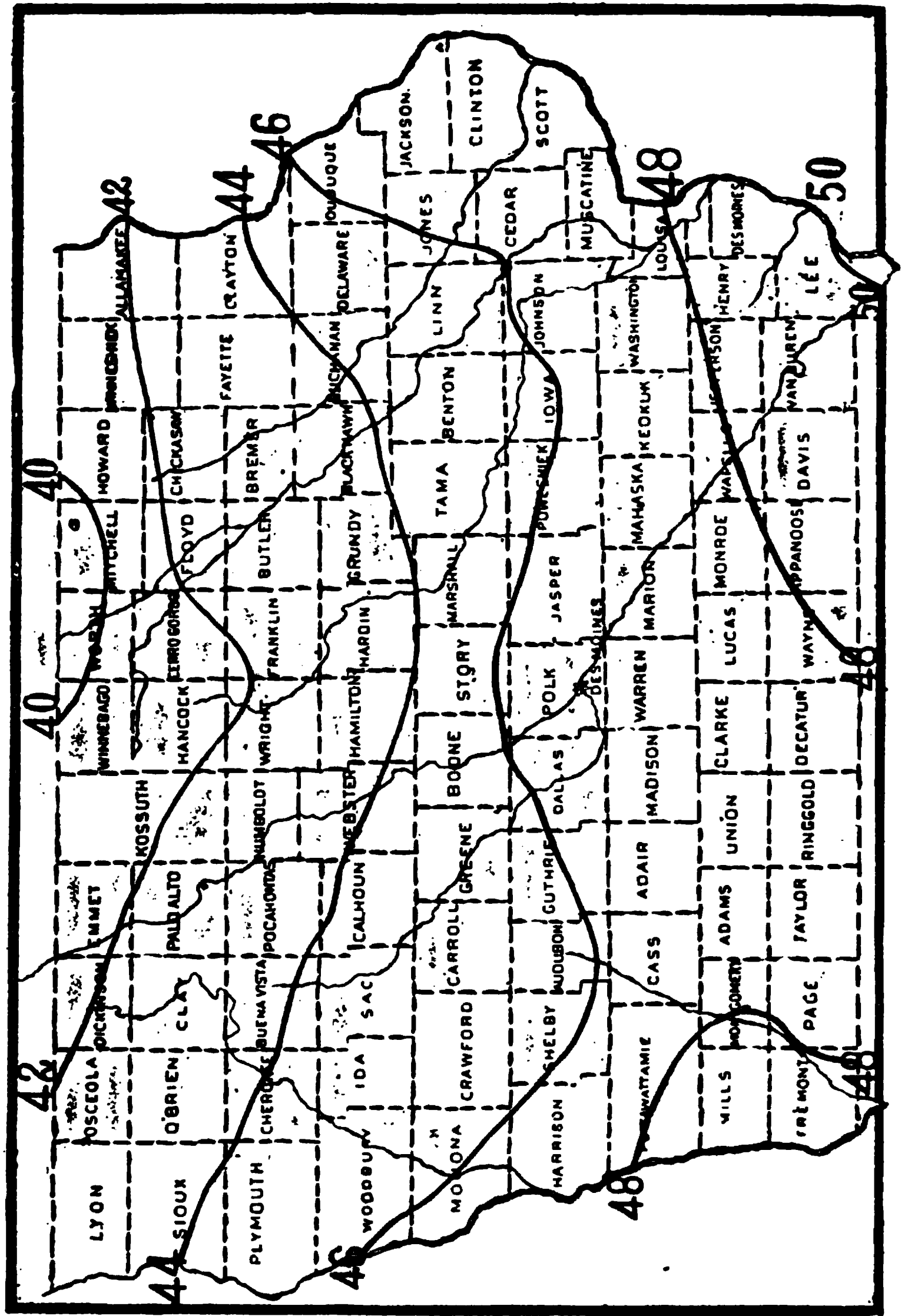
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Average number of days with temperature below zero, 15.  
Average number of days between last and first frost, 130.  
Greatest number of days between last and first frost, 1876, 172.  
Least number of days between last and first frost, 1885, 78.  
Average number of days between last and first snow, 200.  
Greatest number of days between last and first snow, 1854, 271.  
Least number of days between last and first snow, 1875, 141.

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\*Seven days in twenty years.

MEAN TEMPERATURE 1893



IOWA PRECIPITATION CHART 1883

ER.	O	
Total	precip.	Mean.
1.90	49.4	8
1.02	49.9	8
2.63	51.9	8
1.87	51.1	8
1.86	54.6	8
1.88	.....	.....
.....	52.9	98
1.48	52.0	8
1.96	51.8	8
0.85	53.6	8
5.13	55.1	91
1.36	51.0	87
1.75	53.1	85
2.85	52.7	80
4.20	54.3	81
1.77	52.5	84
2.38	54.0	80
4.25	52.7	82
3.29	.....	.....
1.70	54.2	84
.....	49.0	81
3.36	54.7	82
1.15	50.8	82
2.37	48.8	83
.....	.....	.....
1.33	54.8	86
3.31	53.3	82
.....	.....	.....
1.48	51.6	85
.....	49.8	85
1.97	50.5	83
4.88	57.4	84
1.14	52.2	82
1.42	50.4	82











UNITED STATES  
DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU.

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ANNUAL REPORT

OF THE

Iowa Weather and Crop Service

FOR THE YEAR 1894.

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J. R. SAGE,  
*Director.*

GEO. M. CHAPPEL, M. D.,  
*Local Forecast Official, U. S. Weather  
Bureau, Assistant Director.*

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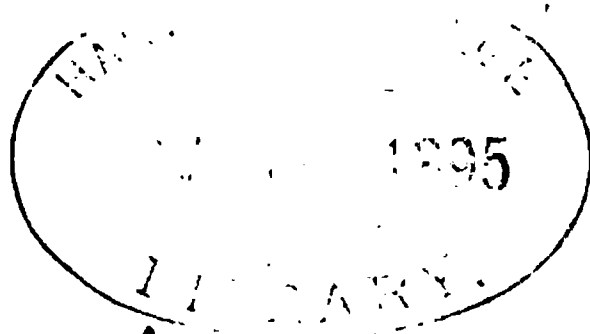
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F. R. CONAWAY, STATE PRINTER.  
1895.

~~Met. 217.3~~

Sci 778.10



The Lona Weather  
and Rep Service

STATE OF IOWA,  
OFFICE OF THE IOWA WEATHER AND CROP SERVICE, }  
*Des Moines, September 1, 1895.*

*To his Excellency, FRANK D. JACKSON, Governor of Iowa:*

SIR:—In accordance with the requirements of the law, we have the honor to submit herewith the fifth annual report of the Iowa Weather and Crop Service for the year 1894.

We are, sir, very respectfully,

Your obedient servants,

JOHN R. SAGE,  
*Director.*

GEO. M. CHAPPEL,  
*Local Forecast Official, U. S. Weather Bureau,*  
*Assistant Director.*



## GENERAL REVIEW.

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The Iowa Weather and Crop Service was established by act of the Twenty-third General Assembly, and was duly organized in accordance with the provisions of the act in June, 1890. The law placed the service under the supervision of the State Agricultural Society, and provided that it should be run in cooperation with the National Weather Bureau, in order that these reciprocal relations might more fully extend to the people the benefits that should be derived from that branch of the public service.

Public interest in its work has been manifested in numerous ways, more especially in the increasing demand for copies of the Weekly Weather-Crop Bulletins, issued during the crop season (April 1 to October 1) and the Monthly Reviews, containing tabulated meteorological reports from stations in all parts of the state, and general matters of meteorological and scientific interest.

Summaries of the weekly bulletins have been mailed to all of the newspapers of the state that evidenced a desire to publish them, and the number of papers to which they were regularly mailed during the year was about 650. The summaries were also given to the daily papers of the west through the press associations. The number of complete bulletins mailed to postmasters, persons, business houses, libraries, etc., averaged 1,600 per week, making a total of about 40,000 copies issued during the season. Through all these avenues of dissemination, the public was kept well informed relative to the condition of the staple crops of Iowa during the period of the great drouth of 1894. During that most trying ordeal, the public anxiety for reliable information relative to the condition of the crops was at times most intense, and the reports of this service were eagerly read by both producers and consumers.

The number of copies of Monthly Reviews mailed from this office during the year 1894 was about 28,500.



The meteorological data and crop statistics embodied in this annual report, were tabulated and summarized at the Central Station from the weekly and monthly reports of 1,100 voluntary observers and crop correspondents, representing every county in the state. To their wholly gratuitous, and always faithful services, the state is indebted for whatever measure of efficiency has been attained by this service.

This volunteer corps is divided as follows: 1st, meteorological observers at stations equipped with instruments for recording temperature and rainfall; 2d, weather-crop observers whose reports are embodied in the weekly bulletins; 3d, crop correspondents, who report acreage and condition of crops during the season.

Following is a list of the permanent stations and observers:

#### METEOROLOGICAL STATIONS AND OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Afton .....	Hon. N. W. Rowell.	Indianola.....	Prof. J. L. Tilton.
Albia .....	Carl Koontz.	Iowa City.....	Prof. A. L. Arner.
Albia (Maxon)....	Gus Johnson.	Iowa Falls.....	J. B. Parmelee.
Algona.....	C. D. Pettibone.	Jefferson.....	Dr. Chas. Enfield.
Alta.....	D. E. Hadden.	Keokuk.....	*Fred. Z. Gosewisch.
Amana.....	Conrad Schadt.	Keosauqua.....	Prof. J. H. Landes.
Ames (Exp. Sta'n)	W. H. Heilman.	Knoxville.....	Casey and Reeves.
Atlantic .....	J. W. Love.	Larrabee.....	H. B. Strever.
Atlantic .....	Geo. W. Franklin.	Logan.....	Mrs. M. M. B. Stern.
Audubon .....	J. F. Hocker.	Mason City.....	H. I. Smith.
Bancroft.....	J. A. Frech.	Marshalltown...	O. M. Cook.
Belle Plaine.....	H. W. Vandike.	Maquoketa.....	Dr. A. B. Bowen.
Blakeville.....	James Rodgers.	Mechanicsville..	Rev. J. W. Hubbard.
Bonaparte.....	Hon. B. R. Vale.	Moorar.....	F. G. Thomas.
Carroll.....	Moses Simon.	Monticello.....	Henry D. Smith.
Cedar Falls.....	Prof. A. C. Page.	Mount Vernon..	Prof. A. Collin.
Cedar Rapids.....	H. D. Olds.	Mt. Ayr.....	Hon. Wm. Shriver.
Centerville.....	Prof. H. E. Belster.	Mt. Pleasant....	Dr. Max. E. Witte.
Charles City.....	J. W. Smith.	Newton.....	A. Lufkin.
Clarinda.....	A. S. Van Sandt.	Ogden.....	E. Sayre.
Clinton .....	Luke Roberts.	Omaha, Neb.....	*L. A. Welsh.
College Springs..	A. A. Berry.	Osceola .....	A. W. Lewis.
Corning. ....	John W. Bixby.	Ovid.....	H. C. Miller.
Cresco .....	Gregory Marshall.	Osage.....	G. D. Pattingill.
Davenport.....	*F. J. Walz.	Oskaloosa.....	Jos. Boyd.
Delaware.....	Wm. Ball.	Ottumwa.....	L. J. Baker.
Decorah .....	F. E. Baker.	Panama.....	Wm. J. Wicks.
Denison.....	M. E. Lies.	Postville.....	F. L. Williams.
Des Moines.....	*Geo. M. Chappell, M.D.	Richland .....	Wm. A. Shaffer.
Dubuque .....	*T. W. Ruete.	Rock Rapids....	W. C. Wyckoff.
Eldora .....	Prof. C. F. Woodward.	Rockwell City...	G. B. Rigg.
Elkader.....	Chas. Reinecke.	Seymour.....	Mrs. O. A. Conger.
Emmetsburg.....	J. A. Carmichael.	Sibley .....	H. G. Doolittle.
Fairfield.....	Charles J. Fulton.	Sidney.....	G. V. Swearingen.
Fayette.....	R. Z. Latimer.	Sioux City.....	*U. G. Pursell.
Ft. Madison.....	Miss L. A. McCready.	Sac City.....	Dr. C. Brown.
Forest City.....	J. A. Peters.	Spirit Lake.....	W. O. Drummond.
Galva.....	W. A. Crowley.	Sutherland.....	W. H. Bloom.
Glenwood.....	Seth Dean.	Toledo .....	Chas. Mason.
Greenfield.....	J. C. Culver.	Vinton.....	T. F. McCune.
Grinnell .....	Prof. S. J. Buck.	Villisca .....	J. F. McCartney.
Grundy Center...	Geo. F. Ellis.	Washington.....	Wm. A. Cook.
Hampton .....	E. C. Grenelle.	Wauke.....	John Wragg.
Hawkeye.....	J. W. Bopp.	Webster City....	O. M. Trumbauer.
Hopeville....	M. T. Ashley.	Wilton Junction.	J. M. Rider.
Hopkinton.....	Theo. Marks.	Winterset.....	Will McKnight.
Humboldt.....	H. S. Wells.	West Bend.....	Phil. Dorweiler.
Independence....	E. F. Wulfke.	Williams.....	M. L. Fuller.

\* U. S. Weather Bureau.

## WEATHER CROP OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Afton.....	M. V. Ashby.	Ledyard.....	Frank Miller.
Agency.....	J. H. Van Zant.	Lawler.....	Hon. Wm. Glattly.
Albia.....	Wm. Mercer.	Lockridge.....	John F. Farman.
Alta.....	Hon. H. T. Saberson.	Manning.....	H. W. Pollock.
Ames.....	Henry O. Wallace.	Mapleton.....	A. Lamb.
Anita.....	H. T. Chapin.	Marshalltown...	Hon. J. G. Brown.
Ankeny.....	Ed. Parmenter.	Mason City.....	Wm. Nettleton.
Battle Creek.....	A. Preston.	Mt. Pleasant....	W. S. Wright.
Bloomfield.....	Geo. Duffield.	Milton.....	Hon. E. O. Holland.
Boone.....	L. C. Morris.	Mount Vernon..	Robert Smith.
Bristow.....	G. W. Wells.	Newton.....	J. P. Beatty.
Carson.....	G. N. Ferguson.	North English...	J. L. Williams.
Centerville.....	Lewis Phillips.	Nevada.....	O. G. Ashford.
Charles City.....	W. B. Towner.	Osage.....	E. W. Stacy.
Charlton.....	C. C. Burr.	Orange City.....	H. J. VandeWaa.
Clarksville.....	F. M. Russell.	Paton.....	A. B. Condit.
Corning.....	Jerome Smith.	Pittsburg.....	G. O. Duffield.
Clermont.....	Chas. Larrabee.	Polo Station....	A. E. Miller.
Concord.....	J. M. Elder.	Prescott.....	G. W. Iden.
Council Bluffs...	L. Prouty.	Paullina.....	Stephen Harris.
Dedham.....	J. A. Horton.	Rockwell City...	J. G. Palmer.
Danville.....	Sherman Matthews.	Rock Rapids.....	D. E. F. Merrill.
Emerson..	D. B. Nims.	Rossville.....	F. B. Wiley.
Ely.....	Hon. A. J. Fuhrmeister.	Sandusky.....	Z. Hollingsworth.
Fulton.....	Carl S. Frank.	Sageville.....	Hon. F. N. Knoll.
Fontanelle.....	Hon. L. M. Kilburn.	Seymour.....	J. F. Wagner.
Ford.....	J. C. Richards.	Shenandoah.....	Reuben Mullison.
Fort Dodge.....	R. W. Blaine.	Spirit Lake.....	C. E. Abbott.
Geneva.....	Wm. H. Thompson.	State Center....	E. N. Thompson.
Grinnell.....	A. O. Price.	Sumner.....	John Dawson.
Guthrie Center..	W. W. Bailey.	Tama.....	W. G. Malin.
Hesper.....	G. E. Dillingham.	Unity.....	Edw. Hummer.
Hodge.....	James Piper.	Van Horne.....	Spencer Smith.
Hamlin.....	F. P. Moore.	Wapello.....	O. P. Smith.
Humeston.....	Hon. S. H. Moore.	Wheatland.....	D. Beckman.
Independence....	C. L. Thomas.	Willow Creek...	W. S. Nicholson.
Indianola.....	T. B. Hammer.	Winterset.....	H. A. Kinsman.
Knoxville.....	B. F. Banta.	Wall Lake.....	T. E. Wilcox.
Larrabee.....	H. H. Carnahan.	Walnut.....	F. L. Martin.
LeMars.....	Hon. Henry Schrooten.	What Obeer.....	O. D. Lawrence.

## DISPLAY STATIONS.

Through the agency of this service 102 display stations have been established and supplied with daily weather forecasts during the year 1894, or for a portion of that period. And during the year a new system was inaugurated whereby a large number of additional towns were served with the forecasts, by postal cards mailed on early trains from central stations, receiving the telegrams each day. By this means a much wider dissemination of the government forecasts and storm warnings has been secured. And at this time, through the daily press, and by the display of signals, and the posting of cards at postoffices, a very large proportion of the people receive the benefit of these forecasts.

### / METEOROLOGICAL SUMMARY FOR 1894.

**Barometer**—Mean pressure for the year, 30.036 inches; highest observed, 30.96 inches, on December 27, at Sioux City; lowest observed, 29.20 inches, on February 9, at Keokuk; range for the state, 1.76 inches; average monthly range, 1.10 inches.

**Temperature**—Mean temperature for the year, 49.7°, highest temperature reported, 109°, on July 26 and 27, at Spirit Lake; lowest, -37°, on January 25, at Ames; range for the state, 146°; average monthly range, 78.8°.

**Precipitation**—Average for the state, 21.95 inches; the greatest monthly rainfall reported was 7.43 inches, at Keosauqua, in September; the least was trace at numerous places in February, July, August and November; the greatest amount reported for any twenty-four consecutive hours was 2.77 inches, at Atlantic, on the 1st of October.

**Wind**—Prevailing direction, northwest; maximum velocity reported was 70 miles an hour, from the south, at Sioux City on June 20.

There were 184 clear days during the year, 109 partly cloudy, 72 cloudy, and 66 days on which .01 inch or more of precipitation fell.

The following table gives the monthly and annual mean temperatures and average precipitation for the state for the year 1894:

MONTH.	Mean temperature—degrees.	Precipitation— inches.
January.. .. .	19.3	1.09
February.....	19.7	1.88
March.....	41.0	2.03
April.....	51.7	3.07
May.....	61.1	1.77
June.....	73.2	2.67
July.....	76.4	1.83
August.....	74.6	1.58
September.....	65.1	3.57
October.....	51.7	2.67
November.....	32.7	1.22
December.....	30.1	1.25
Means.....	49.7	21.95

These figures show that 1894 was one of the warmest and driest years known in Iowa since weather observations have been recorded. The average precipitation for the state was about 13 inches below the normal amount. The mean temperature was about 3.2° above the normal for this state.

The greatest amount of precipitation recorded at any place was 29.81 inches, at Sac City; the lowest was 15.65 inches, at Indianola, for the full year.

MONTHLY WEATHER SUMMARY.

JANUARY.

Mean atmospheric pressure for the month, 30.14 inches; highest observed, 30.81 inches, at Clarinda, on the 24th; lowest, 29.44, at Davenport, on the 20th.

The month of January, 1894, was unusually fine for this region. At the Central Station there were 14 cloudless days, 10 cloudy days, and 7 partly cloudy days. The average temperature of the first decade was 21°; second decade, 36°; last decade, 8°. The extreme cold weather of the month occurred on the 22d, 23d, 24th, 25th, 27th, 28th and 29th.

The daily mean temperature for the state, 19.3°, was about 3° above the normal for January. Ames reported the lowest temperature, 37° below zero, on the 25th.

The average precipitation for the state, 1.09 inches, was about .26 of an inch below the normal. Keokuk reported the greatest amount—2.24 inches. The heaviest snowfall was 12 inches, at Hawkeye and Mechanicsville.

OBSERVERS' NOTES:

*Amana*—CONRADT SCHADT: The lowest temperature was 29° below zero, on the 25th, which was the lowest for quite a number of years. The following days are the coldest on record for several winters:

DATE.	Lowest point reached—below zero.
December 27, 1886.....	33.5
January 6, 1887.....	33
January 15, 1888.....	27
February 23, 1889.....	18.8
January 22, 1890.....	18
November 29, 1891.....	12.6
January 19, 1892.....	21.2
January 13 and 17, 1893.....	19
January 25, 1894.....	29

*College Springs*—A. A. BERRY: A very open January, although a week of severe weather. Fall wheat suffered slightly with drouth.

*Keokuk*—FRED Z. GOSEWISCH: From January 10th to 20th frost was entirely out of the ground and farmers engaged in plowing. First ice cutting began on the 26th, and continued to the 31st; from 6 to 7½ inches in thickness, but of poor quality.

## FEBRUARY.

The mean pressure for the month was 30.20 inches. Highest pressure reported, 30.89, at Davenport and Clarinda on the 23d; lowest, 29.20, at Keokuk on the 9th.

The mean temperature was  $19.7^{\circ}$ , which is about  $3^{\circ}$  below the normal. At the Central Station the minimum temperature was at or below zero on nine days during the month.

The average precipitation was .89 inches—about one-half inch below the normal. The principal storm periods were 9th to 12th and 20th, and the southern and eastern portions of the state received the largest amount of moisture.

## MARCH.

The mean pressure was 30 inches. The highest observed was 30.75, at Clarinda and Omaha, on the 6th and 26th. Lowest, 29.46 inches, at Dubuque and Sioux City, on the 10th.

The month of March, 1894, was a record breaker in respect to temperature. The daily mean temperature of the first and second decades was about  $15^{\circ}$  above the normal—the warmest on record in Iowa. The last decade was the coldest on record, the daily mean being  $10^{\circ}$  below the normal for that period in March. The daily average for the entire month was about  $10^{\circ}$  above the normal. Farm operations were begun at least three weeks earlier than in the average of recent years, and before the 21st more than half the usual amount of small grain was sown. All forms of vegetation were quickened and began to show signs of life. But the last week brought a most damaging change, and the full extent of loss of fruit and grain crops cannot be determined. The mean temperature for the state was  $41^{\circ}$ .

The average precipitation, 2.3 inches, was the normal amount for March. On the whole the month brought less than an average amount of atmospheric disturbance and severe storms. It was an exceptionally warm and pleasant March.

*Temperature*—Monthly mean, as determined from 68 voluntary observers' reports,  $41^{\circ}$ ; highest monthly mean,  $48.4^{\circ}$ , at Ft. Madison; lowest monthly mean,  $34.3^{\circ}$ , at Osage; the highest temperature reported,  $84^{\circ}$ , at Logan, on the 17th; lowest temperature reported was  $5^{\circ}$  below zero, at Larabee, Sibley and Spirit Lake, on the 25th.

## APRIL.

Mean atmospheric pressure, 29.97 inches. Highest observed, 30.40, at Sioux City, on the 5th; lowest, 29.47 inches, at Sioux City, on the 18th.

The daily mean temperature was  $51.7^{\circ}$ , which is  $3.7^{\circ}$  above normal. It was one of the most favorable months for farm operations and crop growth ever known in this region.

The average precipitation, 3.07 inches, was somewhat above the normal amount, but the number of storm days was about the average, and no section suffered materially from lack of moisture. This gave favorable conditions for farm work and the time was well improved in seeding and preparing for corn planting.

The month of April in this latitude is noted for frequent showers, and this year brought no exception to the rule. The average rainfall was a

little above the April normal, and there were about the usual number of showers, some of them notably severe within narrow areas.

On the 17th a narrow belt of disturbance swept across the central districts from Harrison to Clinton counties. The Missouri Valley News gave details of a heavy downpour that occurred in the western part of Harrison county, the amount of rain being variously estimated from six to ten inches. The storm was three to four hours in duration. Many fields were flooded and in the valleys some houses were suddenly inundated, but the damage was only nominal.

Mitchellville, Polk county, on the afternoon of the 17th was visited by a hail storm which caused considerable destruction of windows and store fronts. The Industrial School building suffered heavily. At various points on the line eastward to Clinton county considerable damage was done by hail and wind.

On the 28th, hail storms of notable severity occurred at Lake City and other points in Calhoun county, at Cherokee causing damage to the amount of \$10,000, at Storm Lake and other points along the Illinois Central railway, and at Glenwood, Mills county. At the latter place many hailstones measured twelve inches in circumference, and one large one weighed eleven ounces. The damage to fruit and gardens was quite heavy. In Cherokee county the hail belt was ten miles in diameter.

*Keosauqua*—JOHN H. LANDES: The hail storm of the 28th was one of the most severe that has ever struck this section, continuing nearly an hour. The hailstones were very large, many of them as large as hen's eggs. The principal damage was done to windows and tin roofs; 2.43 inches of rain fell in about an hour, thoroughly flooding the country and damaging plowed fields, gardens, etc. Some bridges were washed out. On the 17th a man was killed near here by lightning, and his son was knocked senseless at the same time. They were near a wire fence at the time.

#### MAY.

The mean pressure of the air was 29.94 inches. Highest, 30.39 inches, at Davenport on the 11th; lowest, 29.34, at Sioux City on the 16th.

The mean temperature of May, 1894, 61.1°, was about 1.4° above the normal. But it was a month of phenomenal extremes of temperature, the general range for the state being from 90° to below the frost line, on the 19th and 20th, causing extensive damage to gardens, small fruit, and field crops in some localities. It was altogether the most damaging frost ever known in Iowa in May, at that stage of crop growth. Lighter frosts, quite general, occurred on the 27th, 28th and 30th. The greater part of the month, however, was warm and bright.

The average rainfall for the state, as shown by the records of seventy-seven stations, was 1.87 inches—2.28 inches below the normal. It was the driest May ever known in Iowa since records have been extensively kept. Only a few localities reported the normal amount. In the last half of the month all districts suffered the effects of this unprecedented spring drouth.

#### SEVERE LOCAL STORMS.

The most destructive storms of the month, in Iowa, occurred on the 5th inst., the damaging effects being noted at a number of points in the central and southern belt of counties.



On the evening of the 5th a small but vigorous tornado passed through the northern part of Appanoose county, continuing its work a short distance into Davis county. It was first observed about two and one-half miles south of Iconium, and it traversed a narrow belt in a southeasterly direction to a point about five miles north and east of Bloomfield, in Davis county.

Prof. H. E. Reister, of Centerville, writes: "It started near Iconium and traveled a little south of east as far as Unionville. It was a terrific storm and tore everything in its way. Near Maine it struck a large church and carried the building and foundation away, leaving scarcely a stone. It blew three cars of coal twenty-five yards from the track. One farmer's house and barn were blown away. A horse in the barn was carried forty rods and left uninjured. Chickens were killed and completely stripped of feathers. The path of the storm was about one hundred yards wide, and can be traced easily, as even the bark from trees and hedges is torn off. The wind here (at Centerville) was from the southwest during the storm, and blowing pretty hard. There was little lightning, but it was very sharp."

Near Maine it struck a house and killed Mrs. William M. McDaniel. The storm is described by various people as having a whirling motion, revolving counter-clockwise. The roar of the storm was heard by numerous persons two to four miles distant. Some hail was observed in advance of the tornado. Hard rain began a few minutes after its passage. There was but little lightning, and mostly after the wind storm passed. The distance traversed was about twenty to thirty miles, and the damage is estimated at \$30,000 — probably exaggerated. A special from Ottumwa says: "Word is received here from Belknap that a destructive tornado swept over a portion of Davis county Saturday evening. About 7 o'clock two heavy clouds met in the Fox river valley, and started to move rapidly in a southeasterly direction along the course of the stream. It soon commenced a whirling motion and assumed the dreadful funnel shape. The cloud was plainly visible from this place, and was watched with a great deal of interest and no little apprehension. The house of Henry Baily, west of Darkville, was the first residence in its path, and Mr. Baily's story-and-a-half house was utterly demolished, scarcely two boards being left together. Mrs. Baily was severely, though it is now hoped not fatally, injured in the wreck, and their 6-year-old boy was so badly cut across the face that one eye had to be entirely removed. A 14-months-old infant was picked up by the wind and carried clear over a barn. It was then dropped quietly onto the earth, where it was found unhurt, with but one little scratch on its body. Another and larger child was blown out into a field, and was met by its parents coming back towards where the house had been, after the storm was over. The houses of a man named Clark and one named Morris were blown from their foundations, and the large barn of P. C. Martin, near Bloomfield, was unroofed. The storm cut a swath an eighth of a mile wide through the heavy timber, tearing trees two feet in diameter up by the roots. It is probable that the timber broke the force of the storm, however, as little damage was done after leaving it."

On the afternoon of May 5 a hail and wind storm passed through the central belt of counties, from Poweshiek to Johnson. At Brooklyn the damage by hail and wind was quite heavy, and for fifty miles eastward there

was a belt disturbance of three to five miles in width, with considerable damage to window glass, roofs, fruit trees and crops. The storm wrought the greatest destruction at Iowa City. Prof. A. L. Arner, of the State University, writes: "This section was visited this afternoon (May 5) by a most disastrous hail storm, occurring about 5 P. M. It began as a thunder storm coming from due west, the rain beginning about 4:30 P. M. The clouds were densely black. After a time hail began to fall, in size about half an inch in diameter. Suddenly a downpour began which will ever be remembered in eastern Iowa. I measured hailstones which were two inches in diameter. One was two and one-half inches in its longest dimension. The damage in this city will reach many thousands of dollars. Besides the destruction of window glass and plate-glass fronts, many tin roofs were riddled with holes, thus exposing valuable goods to damage by rain. The total loss at Iowa City has been variously estimated, from \$50,000 to \$75,000.

On the same evening Clinton was visited by a very severe rain and wind storm, accompanied by a little hail.

#### JUNE.

The mean pressure for the month was 29.94 inches. Highest, 30.28 inches, at Omaha (Neb.), on 6th; lowest, 29.50 inches, at Sioux City, on the 27th.

The month of June was warm and excessively dry. The daily mean temperature for the state was 73.2°, or 4° above the normal.

The average precipitation for the state was 2.67 inches—2.28 inches below the June normal. Following the driest May on record in Iowa, the conditions in June were exceeding unfavorable for all crops except corn. The rainfall was scattering and unequally distributed, ranging from .57 of an inch in Washington to 6.20 inches in Sac City.

But though an unusually dry month, the fact is to be noted that there were only two days on which no rain fell at one or more stations in the state, and there were thunder storms reported at some point twenty-two days in the month.

#### OBSERVERS' NOTES.

*Cedar Rapids*—H. D. OLDS: From May 25 to June 15 there was absolutely no rainfall. Showery the balance of the month. Hay and oats light. Potatoes short. Wells and streams very low. Corn never looked better.

*College Springs*—A. A. BERRY: Ground in very dry condition. No hay, and pastures very short. Small grain an average or above. Large acreage of corn, as much of the oats crop was planted to corn. Rain needed badly.

*Richland*—W. A. SHAFFER: There was not a day in this month but what the sun shone more or less.

*Humboldt*—HENRY S. WELLS: Dry weather prevails. Corn only is not affected by it. Tame grass is too light to cut. All pasture looks like sheep pasture.

*Keosauqua*—JOHN H. LANDES: We have not had a general rain over the county since May 10, although we have had neighborhood rains more or less over all parts. No storm disturbances of any kind this month.

*Mason City*—H. I. SMITH: Severe wind from the west and southwest at 9 P. M. on the 20th blew down outhouses and trees, and store fronts in Mason City, and sheds, barns and wind mills in the country.



## JULY.

The mean pressure for July was 30 inches; highest, 30.21 inches at Clarinda, Des Moines and Omaha on the 2d; lowest, 29.62 inches at Sioux City on the 26th.

July, 1894, has become historic, breaking all previous records and making one of its own as the dryest month ever experienced in Iowa. The mean temperature was 76.4°, which is 2.3° above the normal for the state. The average precipitation was .63 of an inch — 3.67 inches below the normal amount. Over three-fourths of the state received less than half an inch of rain during the month, and a number of localities reported only a trace. The greatest amount reported was 3.50 inches at Centerville.

The culminating period of the drouth was on the 25th, 26th and 27th, during which the wind attained a high velocity and the temperature was expressed in three figures.

At Des Moines, on the 26th, the maximum temperature was 104°, and the wind reached a velocity of 34 miles an hour. The highest temperature reported was 109° at Spirit Lake on the 26th and 27th.

The air was exceedingly dry throughout the month. At the Central Station the mean relative humidity for July was 46 per cent, or about 26 per cent below normal. In July, 1892, it was 73 per cent.

Thunder storms were reported at some points in the state on the 1st, 5th, 6th, 13th, 18th, 19th, 20th, 22d, 23d, 24th, 26th, 27th, 28th, 29th, 30th, 31st.

## OBSERVERS' NOTES.

*Clinton*—DR. LUKE ROBERTS: Notwithstanding last July did not "beat the record" on high temperature, yet it furnished a great number of very warm days, much sunshine, a minimum number of cloudy days and a deficiency in precipitation which beats the record. On the evening of the 19th and morning of the 20th rain fell to the amount of .21 inch, and on the 28th .18 inch more, making a total of .39 inches for the month. This is the total precipitation from the 26th of June to the close of July. While May was quite liberal in rainfall, June was much below normal, so that July was without a fountain to draw from, the result being the most severe and protracted drouth experienced in this locality within the last sixteen years. July, 1890, furnished only .40 inch of rain, but a higher per cent of cloudiness, and in June preceding the precipitation was 6.50 inches, the last storm being on the 30th.

At the close of the month we find pastures dry and valueless, and the feeding of stock a necessity. Corn and potatoes plead in vain for relief, and their value to the tiller of the soil is rapidly diminishing from day to day.

The interest in the great drouth has so absorbed the attention of every one, that no ordinary phenomenon attracts attention. In fact there was but little else worthy of special mention, very little thunder and lightning, and one short exhibition of northern lights on the evening of the 1st. The water in the Mississippi almost reached its low water mark.

*Cresco*—GREGORY MARSHALL: July, 1894, has been the hottest and dryest ever known here, and 105° is the highest temperature reached in that period. The corn is half killed already, with prospect of further damage if drouth continues. Grass seed sown last spring is all lost.

*Glenwood*—SETH DEAN: No thunder storm at Glenwood during July. The most severe drouth ever known here.

*Newton*—A. LUFKIN: At this point we are 12.17 inches short of the normal rainfall up to July 31, 1893, which makes 1,380 tons of water per acre less than the rainfall for the same time in 1893.

*College Springs*—A. A. BERRY: Too much sunshine and altogether too little moisture. Corn cannot make an average of over five bushels per acre and much of it will not make fodder. The 26th we had a regular Kansas hot wind that did inestimable damage. Wheat turning out well, some going as high as 43 bushels per acre and testing 62 to 65 pounds per bushel.

*Cedar Rapids*—H. D. OLDS: Hot weather and no rain to amount to anything sums up the month's record. Crops dried up and stock suffering for want of feed and water, is the only thing to be said.

#### AUGUST.

Mean pressure for the month, 30.01 inches. Highest observed, 30.25 inches, at Cresco, on the 4th; lowest observed, 29.77 inches, at Sioux City, on the 6th.

The month of August was hot and generally dry, bringing but temporary relief from the withering drouth which prevailed through the summer months. The mean temperature for the state was  $74.6^{\circ}$ , which is an average daily excess of  $3.6^{\circ}$  above the normal for August. The first decade brought very high temperatures, almost unclouded skies and but little more than a trace of rain. This heated term culminated in light showers, extending over the larger part of the state. The highest temperature recorded for the month was  $108^{\circ}$  at Logan and Glenwood, on the 10th; lowest temperature,  $38^{\circ}$  at Elkader and Mason City on the 3d, and at Iowa City on the 4th. The temperature range for the state was  $70^{\circ}$ .

The average rainfall was 1.58 inches—2.02 inches below the normal amount. The bulk of the rainfall came within the second decade, 10th to 20th. Newton reports the highest measurement—4.53 inches; the least amount was a trace at College Springs.

Thunder storms were reported from some point in the state on the following dates: 1st, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 20th, 22d, 23d, 24th, 25th.

#### SEPTEMBER.

Mean pressure for the month, 30.00 inches. Highest observed, 30.52 inches, at Clarinda on the 24th; lowest observed, 29.50 inches, at Sioux City on the 28th.

The month of September, 1894, was warmer than the average, and generally very favorable for farm work and the maturing of crops. The mean temperature for the state was  $65.1^{\circ}$ , which is  $3^{\circ}$  above the normal. The highest temperature reported was  $100^{\circ}$ , at Moor on the 1st; lowest,  $26^{\circ}$ , at Rockwell City on the 16th.

The average precipitation for the state was 3.57 inches, which is .13 of an inch below the normal. The southeast district reports the heaviest rainfall, the maximum amount being 7.43 inches, at Keosauqua; the lowest amount, .59 of an inch, at Rockwell City.

At the close of September the records at the Central Station showed a deficiency of 12.39 inches in the amount of precipitation for the preceding nine months.

The heaviest storms of the month occurred on the 20th and 21st. On the 20th a severe thunder and hail storm passed over Des Moines, causing many thousand dollars' damage by hail and flood in the city, and through the counties of Polk, Warren and Marion. The wind storm on the evening of the 21st, passing through the counties of Clay, Palo Alto, Kossuth, Hancock, Worth, Mitchell and Howard, was accompanied by a group of small tornadoes, which caused the death of between fifty-five and sixty persons, and destroyed at least \$500,000 worth of property. It was the most destructive storm of the year in the west.

#### A DESTRUCTIVE STORM.

On the evening of September 21, between the hours of 7 and 11, a heavy storm passed through the counties of Clay, Palo Alto, Kossuth, Hancock, Winnebago, Cerro Gordo, Worth, Mitchell and Howard, and continued with diminished energy across Winneshiek county and thence into Wisconsin. An off-shoot or part of the same storm crossed the line and wrought heavy damage in the southeastern counties of Minnesota. The newspaper and other accounts of the storm indicate that the destruction of life and property was caused by a group of thunder and hail storms, accompanied by heavy wind squalls, carrying in their wake two or three small but vigorous tornadoes which struck the earth at numerous points along the line of the disturbance. The distance traversed, on a nearly direct course east by north, was over two hundred miles. A diagram of the storm belt would show it in fan-shaped form, varying from a few thousand feet at its point of inception to about twenty-five miles in width at its eastern extremity.

A local paragraph in the Le Mars Sentinel states that the first appearance of the storm was near that place, at about 5 P. M. Two mighty currents of air met, it is stated, and a funnel was formed, which left a narrow trail through the corn fields, passing to the northeast within two miles of Le Mars. The storm evidently did not assume a very destructive form until it reached Lincoln and Riverton townships, in Clay county, in which region the complete destruction of buildings began.

From this point in Clay county the Iowa Mutual Tornado Insurance Company reports total losses of buildings in every county and in nearly every township on a nearly direct line to Cresco, Howard county. President Miles Bradford of that company, who has recently traveled over a large part of the storm's pathway in Iowa, adjusting the losses sustained by his association, gives a vivid description of the desolation wrought, and his report leaves no doubt that the bulk of the work of destruction was caused by tornadic movements of the wind at various points along the line.

Fortunately there was no large town directly in the pathway of this destructive storm, but it passed close to the thriving cities of Emmetsburg, Algona, Osage and Cresco and swept through the little hamlets of Cylinder, Hayfield and Lowther.

The first reports of the losses of life and property were somewhat exaggerated, but it has been ascertained that fifty-three persons were killed outright, or died within a day or two after the storm, and some others were

very seriously wounded. The loss of property fell most heavily upon the farmers, and it is impossible to make an approximately correct estimate of the aggregate amount.

W. S. Nicholson, of Willow Creek, Clay county, residing near the track of the storm, at its inception, writes as follows: "At 7 o'clock P. M., September 21st, a heavy storm passed across the county from west to east by north, which developed a path of squalls, blowing down some trees, small buildings and haystacks. The Swedish Lutheran church in Lincoln township was entirely demolished. The storm seemed to become more severe as it moved eastward." Several farm houses were destroyed but no lives were lost in Clay county.

Entering Palo Alto county the storm swooped down and wrought some damage on the divide in the southwest corner of Highland township, then passed lightly over the valley of the Des Moines river, coming down again with destructive force about a mile south of Emmetsburg. Mr. J. H. Carmichael, voluntary observer at Emmetsburg, writes as follows:

During the afternoon the atmosphere seemed heavy and oppressive, the thermometer indicating a temperature of 76 to 78°. The prevailing wind direction was southeast, sky cloudy. The storm was first noticed about 5:50 P. M. in southwest, with nothing unusual in its appearance. The clouds were of a greenish black hue, moving toward the northeast. Thunder was first heard about 6:15 P. M. At this time another storm was observed in the northwest, moving toward the southeast. Blinding flashes of lightning and violent thunder accompanied both storms. So vivid were the flashes and so intense the darkness between them that it was almost impossible to observe the action of the storm clouds.

As nearly as I can ascertain the two storms came together about eighteen to twenty miles west of Emmetsburg. Rain began to fall here about 6:40 P. M., gently at first and with light winds. Thunder and lightning became more violent. The rain ceased about 7:20, thunder and lightning continuing. Suddenly there was a blinding flash of lightning, followed by a tempest of hailstones varying from a walnut to a hen's egg in size. This was accompanied by light winds from both north and east, as shown by broken panes of glass on both sides of houses. The hail storm continued for about three minutes and was followed by a brief calm. At 7:30 the tornado struck the fair grounds, one-half mile south of the center of the town and almost exactly in the geographical center of the county, demolishing the buildings, stables, fences, etc., carrying the buildings and fences on the north part of the grounds to the northeast and those of the south and southeast parts to the southeast, while, singularly, the west fence was carried to the west. The cemeteries adjoining the fair grounds on the south were swept and many of the monuments were overturned, mostly to the east. Across the road east of the cemeteries the house and farm buildings were wrecked and carried to the northeast; 1,500 bushels of threshed oats were carried entirely away. The family had a storm cave close to the house, but were unable to use it, as the usual roar which accompanies tornadoes was not heard, and five members of the family were injured, without loss of life, however. Parties living in and near the track of the storm claim to have seen from one to three funnel shaped clouds; these appeared to some of them to have been of a whitish color. A Mr. Peters, living three miles east of Mr. Foley and almost in the center of the track of the storm, claims to have distinctly seen three of the death dealing monsters; one was to the north and another to the south of him and had passed to the east of his place, moving in a zigzag course; the third one, coming from the west, was almost upon him when he discovered it; he had barely time to drop into his cyclone cellar when it passed over, demolishing his house and out buildings, carrying the debris to the east. The Gallagher brothers' places, a short distance to the northwest of Mr. Peters', were visited and the barns, sheds and granaries destroyed and the fragments carried to the northeast. The trees growing in front of their places on both sides of the road were uprooted and some of them twisted off and blown to the north. Neither of the houses was damaged to any extent. Hundreds of haystacks in the path of the storm had the appearance of having the tops twisted off and carried away, others seemed to have been turned bottom side up. A steel windmill belonging to Mr. Myers was badly twisted and bent toward the west.

The Golden residence, where three of the family were killed, and the barns and sheds of Mr. Cullen, situated about forty rods to the east, were carried to the southeast, while property damaged near the little town of Cylinder, about a mile to the southeast, was carried in an easterly direction. The storm covered a space of about two miles in width. Fortunately, however, it passed through a strip of territory not very thickly settled. In traveling a distance of five miles eastward the storm moved one mile to the north. As near as can be estimated the onward movement of the storm was about thirty miles per hour. The north and middle appendages appear to have done the most damage in this county. A mile on either side very little was felt of this terrible monster, and very few people living in this city realized until the next day how near it came to being another Pomeroy disaster. The only wind that was particularly noticeable in the town was a sudden gust from the north lasting but a moment or two, and supposed to be about the time the fair grounds were struck. The storm, with its almost incessant thunder and lightning, quickly passed to the east. Seven miles east of this place the storm seems to have disappeared, only to reappear about six miles further on in Kossuth county.

No rain following the storm; precipitation, .62 of an inch; temperature after storm, 61°.

The width of the storm track (two miles) through Palo Alto county, indicates that there were three tornado funnels, which moved on nearly parallel lines for some distance, and then diverged as they moved eastward, assuming gradually the form of a direct wind of hurricane force. One of these triplets passed through Worth, crossing the Cedar river near St. Ansgar, thence in a direct line to Le Roy and other points in Minnesota. The other "twisters" kept on the more direct line of disturbance, passing below Manly Junction, striking with renewed force near Osage, then wiping out the little hamlet of Lowther, causing heavy damage at other points in Howard county.

At the little station of Cylinder, southeast of Emmetsburg, six dwellings and a number of outbuildings were destroyed. It is reported that nine people were killed near Emmetsburg and Cylinder, in Palo Alto county.

Kossuth county seems to have suffered heavy loss of life and property. A local paper gave the names of nineteen dead and six more probably fatally injured, within the limits of that county. The Algona Upper Des Moines contains a very full report of the storm, from which the following paragraphs are clipped:

The storm swept across Kossuth county from west to east Friday evening at 8 o'clock, about three and one-half miles north of Algona. It entered the county in Lotts Creek township, and going slightly to the north crossed the Black Oat creek to the river, and then carried destruction along Plum creek, passing over the county line a little north of the Wm. Ward farm. It covered a territory about a mile wide, demolishing barns, mills and stacks. In its path it destroyed everything.

The storm came without warning. The breaking of windows was the first intimation people had of anything to be feared. Some reached their cellars, some were caught at the cellar door. At Algona the wind was from the south. North of the track of the storm the wind was from the north. From both directions it sucked the air into its vortex. In places it struck with incredible fury, and in others the escape of buildings and people was almost miraculous. It took a course no one would have believed possible through wooded creek valleys and across the Des Moines. Some report noticing a roaring sound, but those in the path of it say they did not notice it. The lightning was exceedingly brilliant, but the lack of thunder or any roar was so conspicuous as to excite attention in Algona.

The wind performed many curious freaks along its course. At the Kargleder place an iron pump and the iron tubing were taken out of the well, and here also a granary full of wheat was left untouched. At Barrick's a turkey was stripped of feathers, and over east at Holman's a rooster was trying to crow Saturday morning with its feathers



plucked. At Boever's the reporter found a duck which had lain all night with a heavy beam on its head, and which was able to open one eye and quack when it was released. A turkey with both eyes out, and a pig at Joseph Thompson's with a pine stick in its shoulder several inches are reported. At Mr. Schenck's an old granary stood safely right in the path of the wind. At Mr. Rice's an empty wash tub stood on his water tank in front of the wind mill. The mill and tower and chicken house were torn out completely, but the tub never moved an inch. The chicken house, a heavy 16x16 foot building, was taken around the end of the hay stack and set in between two red oak trees, where it would have been difficult to pull it with horses, without a window glass being broken, and Saturday morning the hens were sitting on their eggs as unconsciously as though they had not been moved. At Mr. Rice's also the window lights were broken in the east end of the house. Fences were destroyed all along, but at the Boever's place the wire was broken and blown about by the force of the wind.

At W. F. Ferguson's only the remains of a willow hedge testify that the place was ever inhabited. His house was scattered for half a mile through the corn field. His own escape was miraculous. With his wife and baby he was carried twenty rods, part way through the willows over rough ground. When the storm was by he found himself holding his wife, both unhurt, and the baby on a piece of the house roof near by, crying, but also unhurt. He gathered all that was left of his fine farm outfit into a wagon box.

West of the Boevers' farm the first place demolished was Fred Pompe's. Everything was destroyed, and Mrs. Pompe, who is a large, fleshy woman, and five little girls had a miraculous escape. The house tumbled down about their ears, but the timbers so fell that a little space a few feet in dimensions was left, and in this they were huddled. After they were taken out no one could believe that they had been in so small a space. Mr. Pompe and the other children had been in town to the fair and had not gone home and so escaped.

The branch of the storm that passed in a northeastern direction wrought some destruction in Winnebago county. The Forest City Summit says:

There seems to have been a division of the storm somewhere near Wesley, in Kosuth county, from which point one funnel traveled due northeast, while the other took a more easterly direction. The line of the first mentioned crossed the northwest corner of Bingham township, in Hancock county, and continued in a northeasterly direction across Winnebago county and passed into Minnesota at section 10, of Eden township. The other cloud crossed the north end of Hancock county, leaving the county at the line of section 1, in Ellington township.

At the Bilstad farm, one mile west of Amund postoffice, the Breckey family and others had a most thrilling experience. There were seven persons in the house, which was picked up and carried several rods and then dashed to pieces. There was a fire in the stove at the time and this ignited a portion of the wreck beneath which A. H. Ross and another person were pinioned. Mr. Ross says that a wall of the building lay across his body, but his head and shoulders were free, and in this position he lay and fought the fire with his hands. Both men succeeded in crawling from under the wreck and at once looked after the rest of the folks, all of whom were found to be safe. Mr. Ross had his face pounded up in a dreadful manner by the flying debris, but is thankful in getting off with his life.

In the northern part of the county the damage to grain stacks was very heavy, and for a distance of seven miles south from the state line it is estimated that the total loss of property will aggregate \$50,000.

J. M. Elder, Esq., of Concord, wrote as follows: "The destruction and loss of life by the tornado of the evening of the 21st cannot be fully ascertained at this time (September 23). The destruction of property within the storm limits was the most complete I ever saw; in fact, complete annihilation. Fortunately the limits were narrow. The time was between 8 and 9 P. M., during which period the electric storm which prevailed, for awful grandeur, was never equaled. The whole heavens were illuminated, disclosing storm centers in every direction, while the thunder was incessant and so terrific that houses were shaken on their foundations as by a distant

earthquake. The reports from other counties are sorrowful indeed. The storm was phenomenal in (1) occurring at so late an hour, (2) occurring so late in the season, and (3) in possessing all the characteristics of a true tornado, as distinguished from a straight wind. I visited to-day five farms upon which the buildings are utterly destroyed, and large quantities of stock lying dead about the ruins."

In Cerro Gordo and Worth counties the loss of life was comparatively light. Through Mitchell county there were two well defined tracks, showing the destructive effects of tornadoes, which are quite fully described in the following report from Observer G. D. Pattengill, of Osage:

On the night of September 21 two tornadoes passed over this county, both of which were destructive to farm buildings and crops in their paths. The northern one seemed to be on its way to LeRoy, Minn. From the point where it entered the county (Twp. 99, R. 18), until near the Little Cedar river, it was very destructive. Besides houses, barns, crops, etc., it picked up a large iron bridge over the Cedar river near St. Ansgar, and left it a wreck, bottom up, some four or six rods up the stream. This tornado moved more to the northeast than its mate. The time was between 10 and 10:30 P. M.

The other storm must have passed over the southern part of Osage, and it dropped down and began scattering grain and corn shocks within a mile eastward of the town. After doing slight damage to buildings a mile or two it reached the great barns of Nichols & Otter, and thence east and but little north, along a road with houses on each side, it left nothing but ruins. It had been raining at intervals after 7:00 P. M., and about 9:30 I noticed much lightning along the west and northwest. At almost exactly 10:00 it began to hail, the wind until this time being almost southeast. It veered to the south, then west, then northwest. The hail was very large, and much glass was broken. There was a constant play of lightning, but no discharges reached the ground, and no signs of it appeared in the wreckage. Many persons were hurt, and five were killed, all within one-half mile; no others in this county so far as I have heard. This storm was going directly toward the little station of Lowther, in Howard county.

The trees and corn on the north side of the track were bent or broken towards the south or southeast, and on south side towards north or northeast. At some points it showed that trees were broken towards the west or northwest as the tornado was approaching, and afterwards other trees and debris were thrown upon them from the opposite direction as the storm passed ahead. This was nicely shown in one grove where a part of the trees fell to the west at the beginning, and over them are laid another lot of trees which fell towards the east and southeast. The center of the tornado did not seem to move forward in a direct line, at times east and again northeast. It seems to me, after looking over a portion of its track, that the wind was rushing furiously toward the center from all points of the compass at the same time, and that there was a very rapid current ascending through the center. Some large and heavy objects, like the bodies of a row of willow trees which had been grubbed out, and were from twelve to twenty-four inches through, were lying on the north side of the road, and north of the storm center. Many of these were moved, some carried over a fence and dropped eight or ten rods south, making some large holes in the ground.

The width of the tornado was about forty rods. In Howard county, Lowther station (Acme postoffice), was struck and every building carried away, but no person was seriously hurt. The buildings on the Howard county fair grounds, near Cresco, were badly wrecked. The storm passed over Cresco, but the tornado had evidently at that point assumed the form of a severe squall, or its force was so far spent that the destruction of property was comparatively light.

The local newspapers of the counties through which the storm passed are filled with details of the storm, sufficient in amount to fill a good-sized volume. All reports and descriptions indicate that it was the most far-reaching and wide-spread wind storm that ever swept over any portion of this fair state.

## OCTOBER.

Mean pressure for the month, 29.93 inches; highest observed, 30.38 inches, at Clarinda on the 13th; lowest observed, 29.44 inches, at Sioux City on the 2d.

The month as a whole was favorable for farm work and for the growth of grass and fall grain. The air was balmy, with a predominance of sunshine, tempered by the Indian summer haze peculiar to this region, making it one of the most pleasant months of the year.

The mean temperature of the month was 51.7°, which is 2.2° above normal. The average rainfall was 2.67 inches—.18 below the normal amount for October. The greatest amount reported was 5.25 inches at Ames, and the least, .63, at Mechanicsville.

## NOVEMBER.

Mean pressure for the month, 30.14 inches; highest observed, 30.80 inches at Cresco on the 28th; lowest observed, 29.32 at Sioux City on the 15th.

The month of November was generally favorable for farm work, but too dry for the farmers' needs, especially in localities where there was a scarcity of stock water.

The daily mean temperature was 32.7° for the state—about 1.5° below the monthly normal. The highest temperature reported 72° on the 15th at Keokuk; lowest, 5° below zero on the 19th at Forest City.

The average precipitation for the state was .92 of an inch—.84 of an inch below the November normal. The greatest amount reported was 2.42 inches at Seymour; least amount a trace at Rock Rapids.

## OBSERVERS' NOTES.

*Cedar Rapids*—H. D. OLDS: No thunder during the month. High winds on the 16th and 27th from the north and northwest, very nearly a gale; but little damage done in this vicinity.

*Larrabee*—H. B. STREVER: Very light rain and snow denote a continuance of the drouhtly conditions. Roads hard, dry and dusty; wells and streams very low. High winds blowing soil in clouds of dust from plowed fields and corn fields from which the stocks have been removed.

*Williams*—MERTON L. FULLER: Only a trace of snow during the month. Ground is dry and roads dusty. Drouth and freezing is injurious to the heretofore good showing of winter wheat, more rain is needed for stock water, and snow for protection of vegetation.

*Shenandoah*—A. A. ATWOOD: First killing frost of the season October 8th—ice three-eighths of an inch thick. November was windy and cold. More than the usual amount of winter wheat and rye sown and doing well. Larger acreage of fall plowing than usual. About 60 per cent of the corn was cut for fodder—selling in the shock of 15 hills at 20 to 35 cents each.

*Fort Dodge*—R. W. BLAIN: The precipitation for the month of November was .18 of an inch. The highest temperature at 1 P. M. was 56° on the 26th; lowest temperature at 6 A. M. was 1° above zero on the 28th. High winds on the 20th and 25th with clouds of dust.

*Bonaparte*—HON. B. R. VALE: The month was warm and pleasant, a little dry, but profitable to man and kind to beast.



DECEMBER.

Mean pressure for the month, 30.16 inches; highest observed, 30.96, at Sioux City, on the 27th; lowest observed, 29.35, at Sioux City, on the 15th.

The month of December was unusually warm, dry and pleasant. The daily mean temperature was 30.1°, which is 7.5° above the normal. The only exceptionally severe weather was during the prevalence of the cold wave on the 26th to 28th. The highest barometer at the Central Station was 30.83, on the 27th.

The average precipitation for the state was .95 of an inch, which is .70 of an inch below the normal amount for December. The amount snowfall was unusually light.

OBSERVERS' NOTES.

*Bonaparte*—HON. B. R. VALE: The following table shows the monthly and annual precipitation at this station for the past three years:

YEARS.	PRECIPITATION—INCHES.												
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Ann'l.
1892.....	1.13	1.66	3.95	7.00	6.00	3.93	4.79	2.18	3.40	.76	2.71	1.89	39.93
1893.....	.10	1.42	2.79	5.13	4.00	4.27	2.40	2.02	5.13	1.45	1.61	1.17	32.39
1894.....	1.40	1.50	2.51	2.83	2.00	1.82	.19	1.60	7.82	1.71	1.80	.52	25.81

*Fort Dodge*—R. W. BLAIN: The year ending December 31, 1894, has been the driest in sixteen years, the total precipitation being 22 inches of snow (unmelted) and 14 89 inches of rain. During the crop season, April 1 to October 1, we had 1½ inches of snow, and 9¼ inches of rain. There were 244 clear days, 23 partly clear, and 98 cloudy. The lowest temperature occurred January 24, when it was 23° below zero. The temperature dropped below zero twenty-three times, and remained below all day for three days. The highest temperature occurred July 26, when it was 104° above, with high wind from the south. The last killing frost was on May 20; first killing frost in the autumn, September 11.

*Clinton*—DR. LUKE ROBERTS: December, 1894, was remarkable for its uniformity of temperature, its abundance of sunshine, and its small amount of precipitation. The per cent of cloudiness was less than for any December for the past sixteen years, and so, also, was the number of storm days. The rainfall was less than any other December during the sixteen years, being only .63 of an inch. Only one other December furnished less than 1 inch of water, viz: 1880—.78 of an inch. A few lonely flakes on the evening of the 26th was all the snow the month could furnish.

REVIEW OF 1894.

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BY DR. LUKE ROBERTS, CLINTON, IOWA.

The meteorological record for the year 1894 is unlike any of the last 16 preceding years in several important particulars.

The first 22 days of January were very mild, and up to the 19th rain was much needed. On the 19th and 20th a copious warm rain fell which weakened the ice in the Mississippi river so that there was an open water way as far north as Bellevue. This was an extraordinary phenomenon for this time of the year. On the 23d 7 inches of snow fell. From this date to the close of the month very good sleighing prevailed, but the cold was away down, finding bottom at 28° below zero.

February furnished considerable cold weather. Snow to the depth of 7 inches fell on the 11th, and was badly drifted by the N. E. wind blowing 26 miles an hour. It may be remembered that this storm, though comparatively light in this locality, was wide spread, covering nearly the whole country, and with devastating results in many places. Its center seemed to pass along or near the Ohio valley, and the great velocity of the wind, which was the interesting feature of the storm, extended hundreds of miles on either side, causing intense discomfiture. The precipitation south of the central belt was rain, and north, snow. An interesting and awe-inspiring phenomena appeared in the heavens on the evening of the 22d, when the auroral lights with flaming structure and vermilion hue graced the northern sky.

The next month was the warmest March in 40 years, except that of 1878. Up to and including the 24th, the weather was more like April, and, thinking seeding time had surely come, many contemplated putting their gardens in order, set cabbage, sweet potatoes and tomato plants. Farmers were plowing and many sowed oats. Much attention was given to putting yards and lawns in order. The Mississippi river opened for navigation on the 6th, and some steamboats were put in service, while others were rapidly being put in order for the season's business. Rain on the 14th was accompanied by a little hail and much thunder and lightning with several very heavy reports, and the flashes of lightning were at times very intense and dazzling. The sky was once more made radiant with aurora borealis on the evening of the 30th. Its behavior was peculiar. In the center diffused cream or light smoke-colored beams with upward pulsating movements, reached and passed the zenith to the south by west; to the eastward, streams tinged with crimson and green shot well up, while from the northwest a more attractive display was in progress. Streams arose from a broad base, and, with crimson and pink and other delicate shadings, reached and passed the zenith to the southeast.

The warmest April in 16 years belongs to 1894. This month was deficient in rainfall. Much thunder and lightning prevailed on the 29th and 30th, a generous rain falling at the same time. At the close of the month the conditions of soil and weather were never more favorable for prosecuting spring work in agricultural lines, and a fruitful season was anticipated.

The weather continued unusually warm all through May, with a normal amount of rainfall. The principal storm of the month came on the 5th, and was precipitated with such a rush that a large per cent found its way to the streams before being utilized by the soil, and the month closed with the crop service in need of more water. On the 19th frost did damage to corn, tomato plants, cucumbers, etc.

June continued to supply warm weather as though it was a pleasure and had the honor of beating all former June records. Notwithstanding this, and the fact that the precipitation was only about one-half the normal quantity, the advancement made in the growth of all immature crops was very satisfactory, and the people were eager to know what hand July would play in agriculture.

July took up the work when June left off, and proved liberal in her very warm days and much sunshine; but her stinginess in rainfall beat the record and thus left us to battle with the most persistent, severe and protracted drouth ever experienced in eastern Iowa. Not satisfied with her excess of heat and deficiency in rainfall, she caused on the 26th and 27th—the two hottest days—a hot wind to blow, which blasted many a field of corn.

At the close of the month pastures had become dry and valueless and the feeding of stock from the corn fields seemed the only alternative. Corn, pastures and potatoes plead in vain for relief, and from day to day their vitality diminished. The interest in the outcome of this great drouth was intense, and continued, as did the drouth until near the middle of August, when relief came and put out the fire, but did not restore to the farmer the value he had anticipated would result from his seeding. But seasonable showers failed to continue, and a relapse ensued, the month departing with a dryness about equal to that on the 1st. There were, however, mitigating conditions prevailing during the latter half of the month, such as copious dews, cool nights, shorter days and humid atmosphere. Thus closed the last of the summer months, whose record for continuous high temperature is without a recorded parallel.

September seemed in pool with the months which had preceded her, and gave us a higher mean temperature than had been her custom. Yet she was kindly disposed. Not only did she furnish delightful days, but brought relief from the long continued and withering drouth, making cheerful, once more, the countenance of man. On the 6th the diamond drops of rain which closed the second edition of the great drouth, made the welcome descent. This gentle commencement of water supply was followed by other precipitation on the 7th, 8th, 9th, 14th, 15th, 21st and 22d, giving us a total of 5.26 inches. The storm of the 14th and 15th gave a depth of water of over three inches, which was a greater precipitation than had before occurred in any twenty-four consecutive hours since the 14th of October, 1886. The September rains put the soil in good condition for plowing; pastures and meadows greatly improved, and stock continued in thriving condition.

Other than the fact that, like her predecessors, October gave a mean temperature above normal, there is little phenomena to record. Excessive heat and dryness had so matured the foliage before its time that several blighting frosts early in the month left the trees denuded ere its close. Although there was no apparent damaging effects to grass, lawns, etc., fields remained green and fresh as though a new lease of life had been granted the vegetable carpeting, and cattle found delight in procuring their food in a natural way.

We pass on through November with its normal meteorological conditions, and find December was remarkable for its uniformity of temperature, its abundance of sunshine and its small amount of precipitation, it being less than in any preceding December during the last sixteen years.

But once did the temperature reach zero, and this for the first time of the season. Following the coldest day of the month, the temperature reached and passed zero about 1 o'clock A. M., on the 28th, dropping 4° below by 7 A. M. The closing day was a lovely one, and as the month brought to a close the meteorological records of 1894, her light flickered and vanished, leaving a parting smile, and bidding us a happy and prosperous New Year.

#### CONSPECTUS.

Highest temperature, 100°; July 24th and August 8th.

Lowest temperature, 28° below zero; January 25th.

Extreme range of temperature, 128°.

Mean daily temperature, 49.8°.

Mean daily range of temperature, 23°.

Greatest mean monthly range, 31.1°; July.

Least mean monthly range, 15.5°; December.

Greatest daily range, 42°; July 23d and May 13th.

Least daily range, 4°; December 23d.

Warmest month, July; mean temperature, 75°.

Coldest month, January; mean temperature, 20°.

Warmest days, July 26th and 27th, 83.5°. The 27th of June only 2° cooler.

Coldest day, January 24th; 10.7° below zero.

Total number of days with maximum temperature 90° or above, 48—3 in May, 15 in June, 18 in July, 9 in August, and 3 in September.

Total number of days with the maximum temperature at 32° or below, 42.

Total number of days with the minimum temperature at or below 32°, 133.

Mean daily cloudiness, 41 per cent of the surface of the sky.

Month with greatest per cent of cloudiness, November—61 per cent.

Month with least per cent of cloudiness, July—18 per cent.

Total number of clear days, 137.

Total number of cloudy days, 78.

Month with greatest number of clear days, July—23.

Month with least number of clear days, January—5.

Month with greatest number of cloudy days, November—12.

Month with least number of cloudy days, July—2.

PRECIPITATION,

Total depth of snowfall, 23 inches.  
Greatest depth of snow at any one storm, 7 inches on the 23d of January, and also on the 12th of March.  
Total precipitation ( rain and snow melted ), 27.47 inches.  
Greatest rainfall at any one storm, 2.61 inches, September 16.  
Month with greatest precipitation, September, 5.26 inches.  
Month with least precipitation, July, .39 of an inch.  
Month with the greatest number of storm days, May and October, 12 each.  
Month with least number of storm days, July and August, 3 each.  
Total number of storm days, 85.

THE WIND.

Total movement of wind 50,040 miles.  
Maximum velocity per hour, 33 miles, in March, the 24th.  
Greatest monthly movement, 6,200 miles, in March.  
Least monthly movement, 2,140 miles, in August.  
Prevailing direction, from the northwest.  
Observations taken at 7 A. M., 2 P. M. and 9 P. M., show the wind to have been from the north, 57 times; from the northeast, 118 times; from the east, 70 times; from the southeast, 94 times; from the south, 146 times; from the southwest, 219 times; from the west, 169 times; and from the northwest, 221 times.

MAXIMUM VELOCITY OF THE WIND BY MONTHS.

	MILES PER HOUR.		MILES PER HOUR.
For January .....	20	For July.....	13
For February .....	26	For August.....	12
For March .....	33	For September.....	32
For April .....	21	For October.....	20
For May .....	26	For November.....	27
For June.....	17	For December .....	27

SNOW AND FROST.

The last spring snow fell on the 28th day of March.  
The first snow of autumn fell on the 10th day of November, but was not of measurable amount.  
Last killing frost in the spring, May 19.  
Light frost, May 11.  
First killing frost in autumn, October 6, and a light frost September 24.  
Number of consecutive days without killing frost, 192.  
The temperature of the air was at the freezing point or below for the last time in the spring on the 13th day of April.  
The first in autumn, October 6.  
The last day in spring when the mean daily temperature was below 32° was March 29.  
The first in autumn, November 9.

ELECTRO METEORS.

Number of auroras observed, 3.  
Number of days with thunder and lightning, 24. None in January, February, July or November.

OPTICAL METEORS.

Number of lunar halos observed, 3.

No solar halos or meteors observed, and but few rainbows.

Following is a table showing the yearly mean temperature, rainfall and movement of wind for the years named:

YEAR.	Mean temper- ature in de- grees.	Rainfall in inches.	Wind move- ment in miles.
1879.....	46.7	34.18	.....
1880.....	47.1	36.18	.....
1881.....	46.2	41.17	.....
1882.....	47.3	41.18	61,460
1883.....	44.0	38.71	63,560
1884.....	45.7	43.40	54,440
1885.....	43.9	38.21	54,490
1886.....	45.6	28.71	49,260
1887.....	47.2	34.01	53,110
1888.....	45.1	35.80	56,205
1889.....	48.1	31.98	49,720
1890.....	48.6	32.62	51,800
1891.....	48.5	33.87	48,625
1892.....	46.4	40.73	43,890
1893.....	46.2	30.89	51,600
1894.....	49.8	27.57	50,040
Means.....	46.6	35.54	52,952

RIVER STATISTICS.

As furnished by Mr. Walden, of the C. & N. W. R. R.

*Opening of the River*—Ice moved on March 6 at 8 P. M., and ran until the river was freed.

The first boat which passed the bridge was the W. J. Young, Jr., going down on March 17.

*Closing of the River*—Ice started to run November 20 at 2 A. M., and stopped at 1:30 P. M., November 20, closing the river. Ice loosened and commenced moving December 11 at 5:30 P. M., and ran out, leaving the river clear from 6 A. M., December 12, to 4 A. M., December 26, when ice again formed, closing the river for the season at 9:10 A. M., December 27. Last boat which passed the bridge was the Helen Mar, going down, Saturday, November 17.

The river was free to navigation 258 days. During this time there were 2,052 boats, for which the bridge had to be swung 1,024 times going up and 1,028 times going down; number of barges, 667; number of rafts, 292.

Highest stage of water in the Mississippi river was 14 feet, 3 inches, May 30; the lowest was only 3 inches above low water mark, occurring on the 26th of August; once in December it was at the 3 inch mark.

Table showing number of boats which passed this point during the last eight years:

YEAR.	Boats.	Barges.	Rafts.	Navigation days.
1887.....	2,753	650	564	261
1888.....	2,627	405	365	221
1889.....	2,592	531	653	228
1890.....	3,064	652	638	273
1891.....	2,821	622	602	240
1892.....	3,253	719	423	244
1893.....	2,494	659	411	255
1894.....	2,052	667	292	258

## RECAPITULATION.

Comparisons extending back sixteen years: 1894 furnished the highest mean temperature; the least rainfall; the least number of storm days; the greatest number of clear days, save 1893, which had one more; the greatest number of consecutive days without killing frost; the dryest atmosphere during the hot months; the greatest freedom from sunstrokes; the lowest average stage of water in the Mississippi river. and the most damaging and protracted drouth.

Notwithstanding this rare combination of extremes, the products of the soil in eastern Iowa may be safely rated at three-fifths of the normal yearly value. Early crops were satisfactorily good, especially oats, which were abundant in yield and exceptionally fine in quality. Hay, corn and potatoes were the greatest damaged products, and yet it is believed there is abundant for home consumption.

TEMPERATURE DATA.

The following table gives the average monthly and annual mean temperature in degrees, at a number of stations in Iowa, from records covering the number of years in the last column.

STATIONS.	JAN.	FEB.	MAR.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	ANN'L.	NO. OF YEARS.
Ames.....	16.2	23.5	30.4	49.3	59.1	69.7	75.3	71.4	62.4	49.2	30.7	22.8	47.4	8
Amana.....	13.2	20.4	29.6	47.8	59.5	68.9	73.4	69.8	60.6	47.7	31.6	21.2	45.4	14
Algona.....	10.7	17.3	26.5	43.6	59.3	67.7	73.8	70.2	59.9	46.8	31.1	17.8	43.6	11
Brookside.....	12.7	19.9	24.1	45.1	59.0	68.6	73.4	69.9	61.0	46.6	31.4	17.5	44.2	9
Cedar Rapids.....	15.8	21.0	30.8	49.0	57.8	69.4	74.3	70.5	61.1	48.7	34.9	25.1	46.9	9
Clinton.....	19.1	22.7	32.2	47.8	59.5	69.2	73.4	70.6	62.5	49.3	35.2	25.0	47.0	20
Oresco.....	9.8	15.4	26.0	43.9	56.4	66.1	70.8	68.5	58.9	45.8	29.2	18.4	42.5	19
Davenport.....	20.8	26.1	34.5	49.8	61.0	70.4	75.0	72.5	64.2	52.1	37.3	28.0	49.3	20
Dubuque.....	18.1	23.3	32.4	48.6	60.2	68.9	74.2	71.5	62.7	50.8	35.4	26.1	47.7	18
Des Moines.....	17.9	23.6	34.2	50.6	60.6	69.9	74.4	72.1	63.6	52.0	36.9	26.5	48.3	13
Elkaker.....	11.3	19.4	29.8	47.8	60.9	69.2	73.9	70.0	61.1	47.8	31.3	21.2	45.0	11
Fort Madison.....	22.4	27.5	37.1	51.2	63.0	73.1	77.6	74.5	65.7	52.7	38.2	28.9	50.8	39
Glenwood.....	15.2	22.3	31.2	46.9	57.9	68.4	72.8	70.1	59.1	46.3	33.2	23.4	45.1	16
Guttenburg.....	13.9	20.0	28.7	44.6	57.8	68.7	70.6	67.9	59.5	47.1	31.9	19.3	44.0	17
Independence.....	14.7	21.8	29.9	47.2	59.7	69.1	73.4	70.2	61.3	48.2	33.2	21.7	45.7	24
Iowa City.....	18.9	23.9	33.3	48.1	60.1	68.8	74.1	71.3	63.0	50.3	35.3	27.6	47.6	16
Keokuk.....	23.6	29.1	37.2	51.9	62.8	72.1	77.1	74.4	66.1	54.1	40.0	29.8	49.0	20
Logan.....	18.0	24.8	34.3	49.2	61.0	69.5	74.8	72.5	62.7	51.8	35.6	24.5	48.3	24
Monticello.....	15.4	21.6	31.9	48.3	59.4	68.4	72.9	69.9	61.4	48.9	33.5	22.1	46.0	37
Mount Vernon.....	17.1	21.8	31.5	48.7	60.5	70.4	71.1	71.2	62.0	49.1	33.8	23.1	46.4	12
Muscatine.....	20.2	24.7	35.0	46.9	59.8	68.1	73.0	70.5	62.4	50.3	25.1	24.3	43.9	52
Nashua.....	8.5	15.4	26.0	41.8	54.9	64.7	70.6	66.3	57.1	48.2	30.6	18.1	41.8	7
Omaha (Neb).....	18.8	25.6	35.4	50.5	62.3	71.1	76.3	74.0	63.9	52.7	36.4	25.4	49.4	19
Oskaloosa.....	16.0	21.0	32.8	49.6	59.7	69.6	75.2	70.9	63.2	49.4	36.4	27.2	48.0	7
Washington.....	16.8	23.7	32.2	50.9	61.1	72.5	77.9	73.6	63.8	51.0	35.4	25.1	49.0	10
Averages.....	16.2	22.2	31.7	48.0	59.7	69.2	74.1	71.0	62.0	49.5	34.1	23.5	46.5	.....

Average for the six growing months of the year, 63.8.



PRECIPITATION DATA.

The following table gives the average monthly and annual precipitation (rain and melted snow) in inches, at a number of Iowa stations, covering the record of years named in the last column. The United States Weather Bureau furnished the data from various official sources:

STATIONS.	JAN.	FEB.	MAR.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	ANN'L.	NO. OF YEARS.
Algona.....	.92	1.57	1.52	2.20	3.46	4.62	3.04	3.82	3.23	2.21	1.30	.99	27.77	16
Amana.....	1.51	1.38	2.03	2.45	3.99	4.95	3.88	3.80	3.53	3.13	2.00	1.55	34.07	16
Ames.....	1.22	1.01	1.55	2.43	3.81	4.69	4.51	3.74	3.76	2.32	1.42	1.04	30.96	9
Brookside.....	1.43	1.67	2.43	2.99	4.82	5.78	5.97	5.29	4.60	3.62	2.24	1.36	40.98	10
Brookville.....	1.26	1.26	1.99	3.06	3.83	4.97	2.82	3.39	3.00	2.95	1.77	1.62	32.24	11
Cedar Rapids.....	1.75	1.73	2.45	2.90	4.78	3.86	4.20	3.39	2.68	3.20	1.65	1.69	33.83	8
Cresco.....	1.38	1.00	1.77	2.16	3.47	5.14	4.32	3.13	3.94	2.36	1.50	1.42	31.45	19
Council Bluffs.....	.80	1.18	1.57	2.53	4.59	5.95	5.23	3.34	3.45	3.04	1.10	.99	33.36	13
Ollinton.....	1.92	2.32	3.27	3.12	4.47	4.63	4.12	3.63	3.23	2.86	1.96	2.11	37.45	17
Davenport.....	1.74	1.63	2.16	2.75	4.40	4.36	3.81	3.82	3.17	2.96	2.06	1.23	34.70	20
Dubuque.....	1.69	1.56	2.31	2.77	3.96	5.08	4.57	3.49	4.31	3.05	2.14	1.85	37.09	18
Des Moines.....	1.40	1.31	1.45	2.56	4.62	5.85	3.19	3.51	3.40	3.53	1.90	1.40	35.06	13
Denmark.....	1.62	2.22	2.46	2.70	4.42	5.78	3.33	3.53	2.80	3.52	1.81	1.95	35.56	12
Dysart.....	1.24	1.24	1.73	2.11	3.89	4.97	4.75	3.80	4.75	3.13	1.79	1.68	34.30	11
Elkader.....	1.59	1.33	1.77	2.69	3.94	4.21	4.79	3.07	4.17	3.03	1.78	2.37	34.74	12
Fairfield.....	1.75	1.66	2.88	3.21	5.13	5.77	3.65	4.02	3.47	3.37	2.71	1.93	41.31	12
Fort Madison.....	1.90	2.08	2.77	3.13	4.30	4.47	3.90	3.88	3.69	2.98	2.20	1.98	37.53	37
Guttenburg.....	1.14	1.17	1.88	2.33	3.55	5.17	4.62	3.62	3.87	2.34	2.01	1.89	34.18	10
Glenwood.....	1.06	.96	1.46	1.69	5.43	5.82	4.14	3.66	2.39	2.82	1.20	.83	31.73	4
Iowa City.....	1.74	1.55	2.53	3.13	4.21	5.03	4.35	4.67	4.24	3.11	2.64	1.74	39.77	23
Independence.....	1.37	1.05	1.79	2.21	4.17	5.03	4.72	3.43	4.70	2.87	1.52	1.48	33.87	22
Keokuk.....	1.73	1.80	2.16	2.96	4.04	4.92	4.19	3.12	8.53	3.15	2.03	1.96	36.87	20
LeOlaire.....	1.58	1.99	2.21	2.74	4.94	5.22	4.09	3.25	8.26	3.49	1.71	1.75	35.20	8
Logan.....	1.30	1.36	2.06	2.63	4.46	5.84	5.41	3.82	8.33	2.61	1.31	1.35	35.51	16
Monticello.....	1.64	1.86	2.50	2.54	3.86	4.51	4.33	3.91	3.94	2.93	2.39	2.39	36.79	37
Muscataine.....	1.81	2.08	2.79	3.41	4.38	4.86	3.91	4.88	8.72	3.04	2.80	2.28	39.22	43
McGregor.....	1.59	1.21	1.90	2.38	3.69	4.96	5.08	3.37	4.04	3.18	1.78	1.79	34.97	16
Nashua.....	1.54	2.23	2.76	2.07	4.19	5.85	6.08	3.87	5.81	3.45	2.34	3.94	45.16	10
Oskaloosa.....	.96	1.11	2.09	2.65	3.43	4.41	3.59	3.12	3.43	2.44	1.82	1.29	31.89	9
Omaha (Neb.).....	.67	.73	1.46	3.11	4.51	5.64	5.15	3.42	3.86	2.77	1.23	1.01	33.06	19
Sac City.....	1.29	1.13	1.53	2.91	4.86	5.38	4.11	3.37	3.46	2.28	1.27	1.28	30.82	15
Waterloo.....	1.18	1.24	1.49	2.00	3.36	3.36	4.05	3.71	4.51	2.27	1.40	1.40	30.76	12
Waukon.....	1.50	1.39	2.21	2.34	3.57	4.83	4.90	3.43	4.41	2.27	1.77	1.74	35.20	.....
Wesley.....	1.14	1.03	1.42	2.30	3.30	4.74	3.50	2.79	3.52	2.17	1.13	2.16	29.60	10
Averages.....	1.37	1.42	2.03	2.60	4.15	4.95	4.30	3.60	3.70	2.85	1.76	1.65	34.86	.....

Total for six growing months, 23.25 inches.

Average per month of crop season, 3.90 inches.

## REVIEW OF THE CROP SEASON, 1894.

The crop season of 1894 opened under promising conditions, and farm operations were begun in this state from two to three weeks earlier than the average of recent years. The daily mean temperature of the first and second decades of March was about  $15^{\circ}$  above the normal—the warmest weather on record in Iowa for the corresponding period in March. The soil was in excellent condition for plowing and seeding, and before the 21st of the month more than half the usual acreage of spring grain had been sown. The seed readily germinated, and all forms of vegetation were quickened into life. The last decade in March brought a most damaging change, the daily mean temperature being  $10^{\circ}$  below normal—making it the coldest on record. The minimum on the 25th and 26th was below zero at many points within the state, causing extensive damage to fruit buds, early planted vegetables and many fields of small grain.

April was warmer than the average, with plenty of moisture, giving promise of recovery from the disastrous set-back of the latter part of March. It was an ideal month for farm work and seeding operations, and the conditions were favorable for the growth of vegetation.

May was a month of extremes, giving a range of temperature from  $90^{\circ}$  to the line of damaging frosts, which occurred at nearly all points within the state on the 19th and 20th. This necessitated considerable re-planting of corn and tender varieties of garden truck. The average rainfall for the month was more than two inches below the normal, the bulk of the precipitation falling within the first decade.

The unprecedented drouth of this season began in Iowa about the middle of May, and from that time until about the 1st of September the heat was excessive, the sunshine almost continuous, and the few scattering showers were not sufficient to afford more than temporary relief from its blighting effects.

The daily mean temperature for June was  $73.2^{\circ}$ , about  $4^{\circ}$  above the normal for the state. The average precipitation was 2.67 inches—2.28 inches below normal. The month, however, was favorable for cultivation of crops and on the 1st of July corn gave promise of considerably more than an average crop. The drouth at that time had not materially injured corn, but its worst effects were shown in the short straw and reduced yield of spring grain and hay, and the generally burned out condition of pastures.

July added to the severity of the drouth by excessive temperature and hot winds. It was altogether the driest July ever experienced in Iowa since records have been kept. The mean temperature was  $76.4^{\circ}$ —about  $2.3^{\circ}$  above normal. The culminating period of the drouth was on the 25th, 26th and 27th, during which period the wind attained maximum velocities ranging from 25 to 38 miles an hour, and the maximum temperature ranged from  $100^{\circ}$  to  $109^{\circ}$ . The average rainfall for the

month was .63 of an inch—3.67 inches below the normal. Four stations reported only a trace, and fully three-fourths of the state received less than half an inch during the month. The mean relative humidity at the Central Station was only 46 per cent.

The first nine days of August were almost entirely rainless, and the month as a whole brought but slight relief from the severity of the drouth. The mean temperature of the month was  $74.6^{\circ}$ — $3.6^{\circ}$  above the August normal. The average rainfall was 1.58 inches—2.02 below the normal. About one-third of the state received less than 1 inch. the bulk of the rain for the month fell from the 10th to the 14th.

The average rainfall for the state during June, July and August amounted to 4.88 inches, which is 7.97 inches below the normal for the summer months. For the same period the average daily excess of temperature was  $3.3^{\circ}$ .

September brought substantial relief, the rainfall and temperature being about normal. The pastures were revived, late potatoes made a good growth, and the remnant of the corn crop was generally matured without damaging frosts. The soil was sufficiently moistened for plowing, and there was an increased acreage of fall grain planted. The shortage of corn and hay necessitated the cutting of corn to save the fodder, and more than one-half the total acreage has been cut and secured in good condition for winter forage. And though the total crop output has been greatly reduced below the average, the state at large has produced an abundance for the support of all its stock and all its people.

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## JUNE CROP REPORT.

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### ACREAGE AND CONDITION OF CROPS—CONDITION OF LIVE STOCK, ETC.

The season of 1894 opened unusually early, and has been exceedingly variable, with unprecedented range of temperature. The first and second decades of March brought daily temperature averaging  $15^{\circ}$  above the normal.

The last decade was the coldest on record for that period in March, the temperature reaching the zero point in nearly all portions of the state. Seeding and plowing were checked, and considerable damage was done to early sowed grain. April was favorable for farm work, and the daily temperature was about  $3^{\circ}$  above the normal. May was variable, the periods of unseasonably high temperature being followed by damaging frosts, the range being from  $90^{\circ}$  to the frost line. The freezing weather on the 19th and 20th checked the advancement of all crops, and seriously damaged fruit, tender vegetation and spring grain in many localities. The most damaging condition has been the unprecedented drouth, prevalent through the larger part of May and the first decade of June. The summarized reports of correspondents, made about June 1, show the following results:

*Winter Wheat*—The conditions were unfavorable for seeding last fall, and the acreage of this crop appears to have been reduced 11 per cent, making the present acreage 207,863 acres. The condition averages 81 per cent.

*Spring Wheat*—There is an average reduction of 9 per cent in the acreage, making the present area only 564,770 acres. Condition June 1, 89 per cent. The total yield of spring and winter wheat is estimated at about 8,500,000 bushels, against 11,000,000 bushels last year.

*Corn*—The reports show an increase in the acreage of corn in every county. The average increase for the state appears to be 12 per cent, which is probably an under estimate. This would give an acreage of 6,738,970 acres. The condition of the crop June 1 averaged 101 per cent. It is unusually clean, and has made an excellent stand.

*Oats*—There has been an average decrease of 3 per cent in the acreage of oats, making a present acreage of 4,029,719 acres. The average condition is placed at 85 per cent. The bulk of these reports were made from the 29th to the 31st of May, since which time the drouth increased in severity, and oats suffered more than any other grain crop. On the 9th of June there was no prospect of more than two-thirds of an average crop in the state, and in some districts it can not exceed 50 per cent.

*Rye*—Decrease in acreage 6 per cent, making the present number of acres 102,957. Average condition, 88 per cent.

*Barley*—Reports show a decrease of about 1 per cent in the acreage of barley sown, making the present acreage 501,031 acres. Condition, 87 per cent.

*Timothy*—Decrease in acreage, 2 per cent; average condition June 1st, 74 per cent.

*Clover*—Acreage, same as last year; condition, 77 per cent.

*Millet*—Increase in acreage, 2 per cent; condition, 87 per cent.

*Broom Corn*—No change in acreage; condition, 94 per cent.

*Irish Potatoes*—Acreage increased 11 per cent; present number of acres, 115,729; condition, 96 per cent.

*Sweet Potatoes*—No change in acreage; condition, 96 per cent.

*Condition of Fruit*—Apples, 82 per cent; peaches, 57; pears, 74; plums, 79; grapes, 69; strawberries, 66; raspberries, 78; blackberries, 86; cherries, 81.

*Condition of Stock*—Cattle 100 per cent; sheep, 99; hogs, 100; spring pig crop, 94; horses, 98; foals, 80.

*Miscellaneous*—Condition of soil, 103 per cent; date of last frost, May 31; date of first corn planting, April 1, in Page county. The season is 13 days earlier than average.

Reports from about 400 well posted correspondents show that the average amount of corn in the hands of the producers is 16 per cent of last year's crop, or a little over 34,000,000 bushels. The amount of oats on hand is estimated to be 11 per cent, or about 11,000,000 bushels.

### JULY CROP REPORT.

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Reports from the crop correspondents of this bureau showing the average condition of the staple crops on July 1 have been received and tabulated, giving the following averages for the state:

Spring wheat, 77 per cent; corn, 107; oats, 66; rye, 80; barley, 70; hay (tame), 43; pastures, 47; millet, 83; broom corn, 90; sorghum, 90; Irish potatoes, 84; sweet potatoes, 81; apples, 71; plums, 74; grapes, 68; blackberries, 77. A special inquiry relative to the acreage and condition of flax showed a decrease of 15 per cent in the area planted and rated its condition 75 per cent. This year's acreage will be 211,460 acres.

Owing to the continuance of the drouth the condition of all immature crops has fallen off somewhat since the 1st of July, on which date the reports were mailed.

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### AUGUST CROP REPORT.

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Estimates of crop condition and yield have been received from over eight hundred correspondents, representing every county in the state. They were generally mailed on or before August 1st, at a time when local showers and weather conditions gave promise of an early breaking of the drouth which had prevailed with great severity through the months of June and July. The reports were based upon the prospect of speedy relief, which has not been realized; in fact, there has been a steady decline in the condition of all unharvested crops, in the larger part of the state, since August 1st.

The reports placed the average condition of crops as follows:

Corn, 40 per cent; flax, 33; millet, 38; broom corn, 47; sorghum, 54; Irish potatoes, 37; sweet potatoes, 46; apples, 58; plums, 58; grapes, 57.

Threshing returns and estimates show the following average yield of harvested crops: Winter wheat, 18; spring wheat, 14; rye, 17; oats, 25 bushels per acre.

If these figures are sustained by the final returns, this state will have over 100,000,000 bushels of oats of good quality, and 11,000,000 bushels of wheat.

### SEPTEMBER CROP REPORT.

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Following is a summary of the September reports of the crop correspondents of this bureau:

The average condition of corn is rated 36 per cent. This indicates an average yield of 11.88 bushels per acre. The present acreage is 6,738,000 acres, and if this estimate is borne out by the final returns, the aggregate for the state will be about eighty million bushels. In the southern and central districts a large portion of the crop has been cut, and the balance is mostly beyond danger from frost. In the northern districts cutting is rapidly progressing, but a portion of the crop is still immature, and would be materially damaged by a killing frost.

The amount of corn that will this year be put into the farmers' cribs will be very light, probably less than forty million bushels. But under stress of necessity the larger part of the fodder will be utilized; and this added to the grain will give, in feeding value, a total corn yield of about 60 per cent of an average, if it is cut and cured in good condition.

Other crops are rated as follows: Flax, 65; potatoes, 35; pastures, 33; apples, 60; grapes, 55 per cent.

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### DECEMBER CROP REPORT FOR IOWA.

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#### FINAL REPORT OF THE SEASON, SHOWING AVERAGE YIELD AND MARKET PRICES OF THE STAPLE PRODUCTS OF IOWA.

The final crop report of the exceptionally unfavorable season of 1894 makes a better showing of the aggregate products of the state than was deemed possible during the period when the drouth was at its height of severity.

**Corn**—Average yield on the basis of the full acreage planted, 12 bushels per acre—a little above one-third of an average crop. Acreage planted, 6,738,970 acres; total yield, 80,867,640 bushels. About 60 per cent was cut and the fodder has been generally secured in good condition; this will materially enhance the feeding value of the crop. Husking returns show more than the usual average of unmerchantable corn. Average price at nearest station, 45 cents per bushel.

**Winter Wheat**—Acreage harvested, 207,863 acres; average yield, 16.7 bushels per acre; total yield, 3,481,312 bushels; price, 51 cents.

**Spring Wheat**—Acreage harvested, 564,770 acres; average yield, 12.8 bushels per acre; total, 7,239,905 bushels; price, 48 cents. Total winter and spring wheat, 10,720,177 bushels.

Estimates of competent observers in every county in the state indicate that about two and a quarter million bushels of wheat have been fed to stock. In the opinion of the director this estimate is in excess of the correct figures.

*Oats*—Acreage harvested, 4,029,719 acres; average yield, 24 bushels per acre; total, 96,713,256 measured bushels, of the best quality and unusually heavy weight; price, 27 cents.

*Rye*—Yield per acre, 15.1 bushels; total, 1,554,650 bushels; price, 43 cents.

*Barley*—Area harvested, 501,031 acres; average yield, 18.4 bushels per acre; total, 9,218,970 bushels; price, 40 cents.

*Flax*—Reports show a decrease of 13 per cent in the area of this crop, compared with last year. Area harvested, 216,436 acres; average yield, 8 bushels per acre; total, 1,731,488 bushels; price, \$1.20.

*Timothy Seed*—Yield, 2½ bushels per acre; estimated product, 376,500 bushels; price, \$2.25 per bushel.

*Clover Seed*—Average, 1.6 bushels per acre; total output, 72,000 bushels; average price, \$5.50.

*Millet Seed*—Average per acre, 9.1 bushels; acreage unknown; price, 67 cents.

*Broom Corn*—Number of tons raised (estimated), 1,200; average price, \$61.70 per ton.

*Sorghum*—Yield, 58 gallons per acre; probable amount produced, 377,000 gallons; price per gallon, 46 cents.

*Irish Potatoes*—Average yield, 40.7 bushels per acre; total product, 4,709,804 bushels; market price, 66 cents per bushel.

*Sweet Potatoes*—Average yield, 37 bushels per acre; estimated product, 110,000 bushels; price, \$1.20.

*Buckwheat*—Estimated yield, 320,000 bushels; market price, 76 cents per bushel.

*Hay*—Average yield ¾ of a ton per acre; estimated product, 1,875,000 tons; price, \$8.20 per ton.

*Prairie Hay*—Estimated amount put up, 1,350,000 tons; price, \$5.00 per ton.

GENERAL CROP SUMMARY—1894.

PRODUCTS.	NUMBER OF ACRES.	AVERAGE PER ACRE.	TOTAL PRODUCT.	MARKET VALUE.
Corn .....	6,738,970	12.0 bu.	80,876,640	\$ 36,394,488
Wheat (winter).....	207,863	16.7 bu.	3,481,312	1,775,469
Wheat (spring).....	564,770	12.8 bu.	7,239,905	3,475,154
Oats.....	4,029,719	24.0 bu.	96,713,256	26,112,578
Rye.....		15.1 bu.	1,554,650	668,499
Barley.....	501,031	18.4 bu.	9,218,970	3,687,508
Flax.....	216,436	8.0 bu.	1,731,488	2,077,785
Timothy seed .....		2.5 bu.	376,500	845,125
Clover seed.....		1.6 bu.	72,000	396,000
Broom corn .....				74,000
Sorghum .....				173,420
Irish potatoes.....		40.7 bu.	4,709,804	3,104,470
Sweet potatoes.....		37.0 bu.	110,000	132,000
Buckwheat.....			320,000	243,200
Hay.....		4-5 ton.	*1,875,000	15,375,000
Prairie hay.....			*1,350,000	6,750,000
Pasturage (estimated).....				20,000,000
Total value .....				\$ 121,284,696

\* Tons.



In the above summary of soil products and their market value, no account is made of the products of orchards, vineyards and gardens, amounting to a considerable sum. Pasturage is estimated and it is believed to be below rather than above the actual value. The estimated total value of soil products in 1893 was about \$200,000,000. The output of the soil this year is believed to be about \$121,000,000.

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## GOVERNMENT CROP REPORT—1894.

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### FOR THE UNITED STATES.

Estimates of the area, product and value by states and territories of the cereal crops, together with those of potatoes and tobacco:

The corn crop of 1894 in rate of yield is one of the lowest on record. In the past 13 years the yield per acre but one year, 1881, was lower, the yield for that year having been 18.6 against 19.4 for 1894. The severe drouth and dry winds in the principal corn producing states reduced the area harvested for grain value to 62,578,000 from 75,000,000 acres planted. The product garnered was 1,212,780,000 bushels, having the estimated farm value of \$554,719,000.

The wheat crop was above the average in yield per acre. The entire product for the country was 360,467,416 bushels, which was below the average for 5 years, 1890 to 1894 inclusive. The farm value of the crop is \$226,902,025. The area, according to revised estimates, is 24,882,436 acres. In the revision of acres the principal changes are made on the spring wheat states. The rate yield is 13.2 bushels per acre. The average value per bushel, 49.1 cents.

Estimates for oats area is 27,023,553 acres; product, 602,086,928 bushels; value, \$214,816,930; yield per acre, 24.5 bushels.

Rye: Area, 1,944,780 acres; product, 26,727,615 bushels; value, \$13,394,000.

Barley: Area, 3,160,602 acres; product, 61,400,465 bushels; value, \$27,134,127.

Buckwheat: 789,232 acres; product, 12,668,200 bushels; value, \$7,040,257.

Potatoes: 7,737,973 acres; product, 170,787,338 bushels; value, \$91,526,787.

Tobacco: 553,103 acres; product, 406,677,385 pounds; value, \$27,760,739.

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## WEATHER CROP BULLETINS.

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### SUMMARIES OF WEEKLY BULLETINS ISSUED DURING THE SEASON OF 1894, ILLUSTRATING THE MUTATIONS OF WEATHER CONDITIONS.

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#### BULLETIN NO. 1, APRIL 10.

Farming operations were begun three weeks earlier than the average of recent years, and in the central and southern districts more than half the usual amount of small grain was sown before the 20th of March. The daily



mean temperature of the first and second decades of that month was 16° above the normal. But the last week in March brought wintry blizzards and temperature close to zero in all parts of the state. It was the coldest weather recorded in Iowa in the last decade of March.

This sudden reversal of weather conditions was damaging to all spring grain that had reached the germinating stage; necessitating the re-seeding of oats over a considerable area. Winter wheat also suffered quite severely, but as the acreage of that crop is quite small the loss will not be appreciable.

All early and tender varieties of orchard fruit suffered severely, especially in the southern districts.

The past week was generally favorable for farm work and good progress has been made in seeding and plowing for corn. The temperature and sunshine were seasonable; the soil was in excellent condition for working, and the copious and general showers of Sunday brought the much needed moisture.

The season is about a week earlier than the average, and the general crop outlook is much better than it was in the latter half of April in the last two years.

#### BULLETIN NO. 2, APRIL 17.

The weather during the larger part of the past week was cool and cloudy, the daily average temperature being below normal, and the sunshine only about 30 per cent. The rainfall has been abundant for present needs, and was well distributed.

The conditions on the whole were favorable for farm work, which is now, in all parts of the state, well advanced. An unusually large acreage has been prepared for corn, and farmers will be able to take advantage of the first favorable weather for planting. The soil is in excellent condition.

Spring cereals are coming up nicely, and the damage from the March freeze will not materially reduce the acreage of oats. In the northern districts flax seeding is in progress.

Live stock is generally in excellent condition; there is an abundance of forage on hand, and grass is making a fair start.

The outlook for orchard fruit is better than was indicated two weeks ago.

#### BULLETIN NO. 3, APRIL 24.

The past week brought the usual variety of April weather, the temperature ranging from the frost line to 18° above the normal, giving a seasonal average for the week. There was less than the average amount of sunshine.

The rainfall was variable, coming in form of local showers of greater or less severity. A few localities report heavy downpours, accompanied by hail, resulting in slight damage.

Good progress has been made, and farm work is at least two weeks further advanced than at the corresponding dates in the last two seasons.

The acreage of ground plowed for corn is exceptionally large because of the winter-killing of clover on an extensive area. If the weather is favorable planting operations will begin the present week.

All small grain crops are doing fairly well. Grass is making a good start, and by the first of May pasturage will be abundant.

No material damage resulted from the freezing temperature which occurred on the 20th.

## BULLETIN NO. 4, MAY 1.

The month just closed has been unusually favorable for farm work and the advancement of crops. The daily mean temperature for the month was 2° to 3° above normal, and the rainfall was seasonable in amount.

The past week brought high temperature and abundant sunshine, closing with copious and well distributed showers, greatly improving all crop prospects and conditions.

Cereals and grass are doing notably well. Reports indicate that a very large acreage is prepared for corn, and in every district a good beginning has been made in planting. With a continuance of the present favorable conditions the bulk of planting will be done before the 10th of May, or two weeks earlier than the average.

Fruit prospects are very much better than was anticipated at the beginning of April.

## BULLETIN NO. 5, MAY 8.

The past week has been generally favorable for all crops, and for farm operations. The temperature was seasonable. The rainfall was ample in the larger part of the state, and excessive in a few localities. The amount of sunshine was about an average.

All vegetation has been pushed rapidly. Small grain and grass, where there is a good stand, never looked more promising at close of the first week in May.

Good progress has been made in planting corn in all districts, except where the soil was too wet. Taking the state as a whole planting is about one-half completed, and conditions are favorable for a good stand. An increased acreage of potatoes has been planted.

On Saturday evening destructive hail storms passed through the east central district, from Poweshiek to Clinton, causing greater damage to windows and roofs than to crops.

## BULLETIN NO. 6, MAY 15.

The past week has been favorable, with temperature and sunshine above the normal, and the rainfall generally sufficient for present needs.

Corn planting is nearly completed in all districts of the state, except in a few localities where work has been delayed by excessive moisture. In early planted fields an excellent stand has been obtained, and there is less than the usual complaint of poor seed. The work of cultivation is in progress in all sections, with the soil in fine condition.

Small grain, potatoes, meadows and pastures are doing notably well. The staple crops of this state have never been more promising the middle of May. The outlook for fruit continues to be fairly good.

## BULLETIN NO. 7, MAY 22.

The past week brought unseasonable extremes, the temperature ranging from 90° to the frost line. High winds prevailed the first half of the week, causing rapid evaporation of the scant moisture in the soil. The average rainfall was generally deficient.

Reports of frosts and freezing temperature on the 19th and 20th come from all sections of the state, but the extent of damage cannot as yet be determined. Garden truck, grapes and small fruit suffered most severely.

In many sections corn was cut to the ground, but it was only checked in growth and not materially injured. Potatoes are not believed to be permanently damaged. Small grain crops have suffered more from hot and dry winds than from freezing.

In the larger part of the state the hay crop will be considerably shortened by the drouthy conditions. Rain is needed in all districts.

The acreage of corn has been materially increased over last year, and the outlook for that crop is unusually promising.

BULLETIN NO. 8, MAY 29.

The past week was unseasonably cold and dry, with less than the normal amount of sunshine.

From the effects of frosts and drouth the general crop conditions are not so favorable as they were two weeks ago.

Corn has partially recovered from its set-back and is in a fairly promising condition, with a good stand and improving color. The usual complaints are heard of the ravages of cutworms, and some replanting has been necessitated. The acreage has been increased by the partial failure of oats in many localities.

The prevalent drouth is injurious to all spring grain, and the hay crop is damaged past recovery. Pastures are becoming very short, and in many sections stock water is scarce.

The recent freezing temperature was most destructive to truck gardens, grapes and small fruits.

BULLETIN NO. 9, JUNE 5.

Reports from all parts of the state are burdened with complaints of continued dry weather and serious injury to grass, grain, early potatoes and small fruit. The average rainfall during the month of May was less than half the normal amount, and in the larger part of the state the last three weeks were practically rainless.

Grass and oats are suffering the greatest damage from this almost unprecedented spring drouth. The early hay crop will be extremely light, and in the central and southern districts the damage to oats is beyond recovery.

Corn has been retarded by cool weather, but it is generally in good condition. The stand is good and the fields have been thoroughly cleaned. With favorable conditions the balance of the season Iowa will produce a corn crop of old-time proportions.

Pastures are very short, and in many localities cattle are receiving extra rations of fodder.

BULLETIN NO. 10, JUNE 12.

The first half of the past week was cool and dry; the last half brought higher temperature, with light local showers in the west central and southern districts, closing with promise of an early breaking up of the protracted drouth.

All crops except corn have suffered materially from effects of the drouth. Oats cannot exceed two-thirds of an average even with the best conditions in the future, but the quality may be better than in recent years. Spring wheat and barley have lost several points since June 1st. Late potatoes

are fairly promising. There will be less than half a crop from the first cutting of timothy and clover. Corn has never given better promise of a full crop at a corresponding date in June.

BULLETIN NO. 11, JUNE 19.

The first half of the past week was excessively hot and dry; the lower temperature during the last half brought refreshing showers, which broke the drouth in the larger part of the state. The heaviest rainfall is reported from the eastern, northern and southwestern districts, the most arid portion of the state being some of the central and northwestern counties.

More rain is needed, and the prospect is favorable for an early restoration of the normal conditions. Corn has steadily advanced, and with favorable weather will make a great crop. Oats, barley and hay have been most injured by the drouth, and are beyond recovery. The yield of oats for the state cannot exceed 60 per cent of an average, and it is more likely to go below 50 per cent. Many reports say the small grain fields are being plowed for millet or used to pasture stock. Pastures will speedily revive. Potatoes are doing well.

BULLETIN NO. 12, JUNE 26.

The daily mean temperature of the past week ranged from 3° to 5° above the normal, closing with cooler weather and well distributed showers. The drouth is practically broken in all parts of the state, though in the central district more rain is needed to revive pastures and replenish the water supply.

Corn was never cleaner or more promising in the last week of June. The stand is remarkably even, and in the larger part of the state it is about ready to "lay by."

Oats have headed with short straw, and the heads are generally deficient in number of grains. The quality of the yield is likely to be better than in recent years.

The harvest of winter wheat and rye is in progress in southern districts, with fair yield. Barley harvest will begin a week earlier than usual; the crop about two-thirds of average. Potatoes give promise of a fair crop. Flax is doing well.

BULLETIN NO. 13, JULY 3.

The summary for the month of June, at the Central Station, shows the mean daily temperature to have been 4° above the normal, with less than one-fourth the seasonable amount of rainfall.

The past week was unseasonably warm, with drying winds, tempered by light showers. The reports show an abundance of rainfall in scattered localities, but it has been below the normal amount in the larger part of the state.

There has been generally a marked improvement in the condition of all immature crops. Corn shows the most notable advancement. It is clean, of good color, and will be generally "laid by" on or before the 4th.

Oats are filling remarkably well, and gaining slightly in height, giving promise of a yield fully equal in weight to the output of 1893. Haying and the harvest of winter grain are in progress, and a beginning has been made in cutting barley.

## BULLETIN NO. 14, JULY 10.

Bright and hot days with cool nights prevailed during the week, the average temperature being about 2° below the normal.

A few localities report light showers, but the larger part of the state was destitute of rainfall, and the drouth has resumed sway with increased severity. Its worst effects are visible in the pastures and potato fields.

Corn is holding its own remarkably well, and thus far has suffered no material damage. The harvest of oats and barley is in progress in all districts. In some of the northern and northeastern counties the yield of these cereals will be very near the average. In the bulk of the state they will not exceed half a crop. The tame hay crop has been mostly harvested, with less than half an average yield.

## BULLETIN NO. 15, JULY 17.

Another hot and dry week has added to the severity of this unprecedented drouth.

Cool nights have afforded some mitigation to the hot days, but the rainfall has been little more than a trace in any part of the state.

Reports from all stations indicate that while corn is holding its own notably well, the crop has reached the danger line, and every day's continuance of the present conditions will lower its average yield.

Pastures afford but little feed, and stock requires double rations. Streams and wells are at or below the low water mark.

Potatoes show serious damage, and many fields are past recovery.

Oats and barley are being secured in the best possible condition. Threshing of winter wheat and rye in operation.

## BULLETIN NO. 16, JULY 24.

High temperature and bright sunshine prevailed the larger part of the past week, and the drouth remains practically unbroken. The showers on the 19th and 20th afforded temporary relief in narrow belts and spots, covering probably about one-third of the state. A few scattered localities report rainfall sufficient for present needs; but in the bulk of the state the amount was too light to give any appreciable benefit.

The pastures are bare, and the live stock is suffering for feed and water. All unharvested crops have reached a critical stage, and every day's continuance of the drouth adds to the extent of the injury already done.

Within the past two weeks corn in the larger part of the state has steadily retrograded, and the extent of injury can not as yet be estimated. In the driest of the "burnt district" the damage is beyond recovery, but in many of the northern counties the prospect is better. Taking the state as a whole the crop is likely to be less than two-thirds of an average, and a continuance of present conditions will reduce it far below that figure.

Potatoes, flax, millet and grass have suffered great damage.

## BULLETIN NO. 17, JULY 31.

The past week has been the worst of the season. The daily temperature averaged 7° above the normal. On the 26th the temperature ranged from 100° to 107°, with winds 20 to 35 miles an hour, the severest in effect upon vegetation ever known in Iowa.

Light showers are reported along the eastern border, and at a few localities in the interior, affording temporary relief in checking the process of desiccation.

Variable reports are received as to the effects of the drouth and hot winds upon corn. In the central and southern districts the damage is much greater than in the northern belt. The consensus of opinion seems to be that about one-fourth of the acreage planted will yield no corn and but little fodder. With speedy and substantial relief the state at large may possibly harvest one-half an average crop. But every day's continuance of present conditions will lower the possibilities and reduce the output.

Pastures are dry, and feeding stock is now general. Late sown millet has not sprouted. Potatoes and flax are greatly damaged.

Threshing returns show much better yield of rye, wheat, oats and barley than was expected.

#### BULLETIN NO. 18, AUGUST 7.

The daily average temperature of the past week was slightly below normal, the days being bright and hot and the nights cool.

The rainfall was generally deficient and badly distributed, a few localities reporting copious showers while the bulk of the state received no substantial relief, and the drouth is unbroken. The heaviest measurements of rainfall are reported from the western districts.

In the few counties where the showers were heavy a slight improvement in the condition of the late corn is noted, but a very considerable percentage of the crop is beyond recovery.

Reports received and tabulated from over 800 correspondents of the State Bureau, representing every county in the state, place the average condition of corn on August 1 at 40 per cent. The highest averages are reported in the northern tier and a few counties on the Mississippi river. There has been a slight falling off in condition since these reports were mailed.

Returns from threshers indicate that the aggregate yield of oats is likely to equal the amount harvested in 1893, and the quality is much better.

#### BULLETIN NO. 19, AUGUST 14.

The daily mean temperature of the week was about 8° above normal, the maximum ranging from 90 to 100°, with a very high percentage of sunshine.

Until the 10th the conditions were about as damaging as at any time during the season. The showers of the 10th, 12th and 13th gave substantial benefit to the larger part of the state and will materially help grass, millet, late potatoes and a portion of the corn crop.

The condition of corn is variable, depending upon quality of soil for retaining moisture and shelter from full force of hot winds. There has been a material deterioration since August 1, when it was rated at 40 per cent. A large portion is now beyond help and is being rapidly cut to save the fodder. With favorable weather in the future there is a possibility of saving one-third of an average crop from the present reduced area of less than 6,000,000 acres.



## BULLETIN NO. 20, AUGUST 21.

The daily mean temperature of the past week was about 3° above normal, with an excess of sunshine, but the general conditions have been decidedly more favorable for all unharvested crops.

The drouth has been effectually broken by copious showers in two-thirds of the state, the southwest and south central districts receiving the least amount.

Reports show an improvement in the condition of corn fields where the vitality of the plant has been maintained and the ears have been formed. A very large portion of the acreage planted has been or will be cut for fodder, and all reports confirm the previous estimate that the total amount of merchantable corn cribbed this year will be about one-third of the average yield of this state.

Pastures are beginning to revive. Potatoes, late sown flax and millet show an improvement.

A good beginning has been made in fall plowing.

## BULLETIN NO. 21, AUGUST 28.

The week has been warm and dry, the daily mean temperature ranging from 2° to 4° above normal, with very light rainfall. The nights were cool, however, and heavy dews mitigated the drouthy conditions.

Corn is doing as well as could be expected. Considerable improvement is noted in districts which had the heaviest rainfall. Some of the more advanced fields will be matured beyond danger of frost within two weeks. The work of cutting for fodder is progressing.

Decided improvement is noted in favored localities in the condition of pastures and meadows; but in the larger part of the state stock still require extra rations. Potatoes give promise of from 20 to 40 per cent of a crop. Plowing is in progress where the land is not too dry, and some seeding has been done.

## BULLETIN NO. 22, SEPTEMBER 4.

The daily temperature of the past week ranged from 3° to 7° above normal. The extreme drouthy condition were mitigated by light showers on Sunday and Monday, extending over the larger portion of the state.

The drying and ripening process has gone on rapidly and early planted corn is now near the line of safety from damage by frost. Cutting for fodder is now general in all parts of the state, and more than 50 per cent of the entire acreage will be cut and fed without husking. In the southern districts fully 80 per cent will be cut and used as fodder, the grain being separated by threshing. There is no change in the condition of pastures and immature crops.

## BULLETIN NO. 23, SEPTEMBER 11.

The daily temperature of the week averaged about 5° above normal. The drouth has been effectually broken in all parts of the state except in some of the northwestern counties. Pastures and meadows have been greatly improved, and a fair crop of late potatoes is assured with exemption from killing frost the balance of this month.

The average condition of corn is rated at 36 per cent. This indicates an average yield of 11.88 bushels per acre. The present acreage is 6,738,000

acres, and if this estimate is borne out by the final returns the aggregate for the state will be about 80,000,000 bushels. In the southern and central districts a large portion of the crop has been cut, and the balance is mostly beyond danger from frost. In the northern districts cutting is rapidly progressing, but a portion of the crop is still immature, and would be materially damaged by a killing frost.

BULLETIN NO. 24, SEPTEMBER 18.

The temperature of the past week was slightly below normal, and the frost line was reached on the 11th and 15th. The larger part of the state received more than the normal amount of rainfall.

No material damage resulted from the frost. Corn is generally safe; fully 60 per cent of the crop is in shock, and cutting is still in progress.

The soil is in good condition, and more than the average amount of fall plowing will be done. There will be an increased acreage of fall wheat and rye; the early seeded is up and looking unusually well.

Pastures are again furnishing feed for stock. Late potatoes are showing marked improvement.

The latest threshing returns give promise of a total yield of 120,000,000 bushels of oats.

BULLETIN NO. 25, SEPTEMBER 25.

The temperature of the past week averaged about normal, though it began and closed with frosts of considerable severity in northern and exposed localities. The rainfall was very heavy in the central and southeastern districts, and ample in all sections except in some of the western counties. Considerable damage was done in central counties by hail on the 20th, and by heavy wind storms in the northern tier of counties on the evening of the 21st.

There is but little change noted in the condition of crops. Corn cutting has progressed as rapidly as local conditions would permit, the amount reported in shock varying from 25 to 85 per cent.

Good progress has been made in fall plowing, the amount being more than the average of the last two seasons, and the soil is generally in good condition. Seeding of winter wheat is not fully completed. The early seeded fields show fine growth. Pastures which were not burned out by the drouth are doing notably well. Late potatoes will average less than half a crop in the state at large.

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THE DROUTH PROBLEM.\*

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A question most vitally affecting the dairy industry is that relating to the permanence of the climatic conditions which have given Iowa its foremost place among agricultural states. Confidence is the basis of all business activity. We know what the past has brought forth, but what of the future? Are drouthy summers and hot winds to be the rule, instead of exceptions, in the years to come?

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\*A paper read before the Iowa Dairy Convention at Ames, November 15, 1894, by J. R. Sage.



The dairy interest, more than any other branch of agriculture, is directly affected by the answer to these inquiries. We can raise fair crops of small grain and corn with our minimum of moisture in mid-summer; but for an abundant supply of hay and pasturage we must have ample spring rains and frequent summer showers. Corn is a sub-tropical plant which with wise culture will thrive fairly well in arid conditions; but grass is at its best only in the temperate zone, in the region where the clouds furnish all necessary irrigation. And grass is a prime factor in dairying on a large scale.

Perhaps some of you may be surprised by the statement that, during the past ten or fifteen years, the grass crop (hay and pasturage) has brought larger net returns to the farmers of Iowa than the vast crops of corn and oats combined. In saying this it should be explained that about thirty-seven per cent of the corn crop has been wasted by not harvesting the stover. This statement emphasizes the need of ample summer moisture, which is essential to the production of grass.

The grass crop suffered most serious damage by the great drouth of the past summer. The output of hay was cut short over fifty per cent, and the pastures were rendered practically worthless for grazing for a period of nearly three months. To a large extent the roots were destroyed by the intense heat and close grazing of the hungry stock. There was a general failure of streams, reservoirs and wells, and dairymen were obliged to skirmish around at a lively rate to provide water as well as forage for their suffering herds.

The unusual experience of the past season has stimulated public interest in some of the problems of meteorology, and people are making the discovery that the tables and records of the weather clerks are not merely dry figures after all, nor wholly devoid of value to practical people. The drouthy season cut short the products of the farms, but we have grown a large crop of interrogation points, and a great variety of theories, speculations and weather prognostications for the years to come—some wise, but many otherwise.

Now it's a good thing to quicken inquiry and investigation, but it is still better to obtain correct answers. An interrogation point is something like a corkscrew, which may serve to uncork healing balm or deadly poison.

A current inquiry for the past year or two has been, "Can we make it rain?" and in the drouth-stricken regions thousands of dollars have been paid to professional rain-makers to settle the question, resulting in the conclusion that their prescriptions fail to operate in an extremely dry season.

Another class of inquirers, who take no stock in the operations of rain-fakirs, have anxiously asked: "Wherefore this extraordinary shortage of rain?"—"What's the matter with our climate?"—"Is this aridity of earth and air the result of drainage and cultivation?" These are some of the questions asked by honest and intelligent men; and I regret to add that a considerable number have accepted the pessimistic theory that to a large extent our recent drouths have been produced by human agency—that is, by drainage and cultivation.

Now, if this theory is true, we may as well prepare to join the caravan of drouth-stricken settlers from trans-Missouri regions, who are moving

eastward to live with their wives' relations. We shall not be able to support our present and prospective population if it is true that cultivation of the soil is steadily converting this garden of the continent into a barren desert. But I would suggest that those who are contemplating moving out on this account had better get an early start while the roads are good, for if they tarry long the highways may relapse into their normal state of wetness and impassability.

A few years ago the opposite theory obtained wide acceptance, and boomers of western lands stoutly maintained that the advance of settlements and cultivation had brought an increased amount of rainfall along the railroads and over the semi-arid plains. This widely disseminated theory was carefully investigated by scientists, who were reluctantly forced to render the Scotch verdict, "Not proven." But the proposition that cultivation of the soil for the production of crops increases evaporation, humidity and rainfall can be sustained by a much stronger array of facts and arguments than the opposite theory.

The truth is, however, that there is no substantial basis of fact to sustain the current notion that either rain storms or drouths are in any measure caused by human agency. A thorough study of the laws that govern storm movements will serve to convince the thoughtful student that the gigantic forces of nature brought into exercise in the production of the smallest shower are infinitely above the grasp of finite man.

Without going into the purely scientific field, a few salient points may suffice to allay the fears of those who have been worried by the problem of the recent drouth, whether or not we have ruined our climate by draining our bogs and plowing under the wild grasses of the prairies.

To those who are troubled by the pessimistic weather theory we may apply the words of the biblical preacher, "Say not thou, 'What is the cause that the former days were better than these?' for thou dost not inquire wisely concerning this." Those who ask why the climatic conditions were so much more favorable in former than in latter years do not inquire wisely concerning that matter. The shortage is mainly in their remembrance, or in their knowledge of weather conditions covering a sufficient period to serve as a basis for a just conclusion. This year the average total rainfall for the state in the four crop growing months—May, June, July and August—was only 6.75 inches. This notable deficiency in moisture is cited as positive proof that the state is drying up. But in 1892, during the corresponding four months, the total rainfall for Iowa amounted to 21.49 inches—an average of 5.37 inches per month. That was only two years ago—surely our theorists ought to remember the immense and damaging floods of that season. Are we to infer that our tile ditches were not in working order that season?

There had been a great deal of ditching done prior to 1881, and yet in that year the total rainfall at Des Moines was 56.81 inches, of which amount 26.65 inches fell in the three summer months. In 1882 the summer rainfall at Des Moines was 20.08 inches; in 1885, 16.68 inches; and in 1886 only 2.58 inches.

These figures show great variability, but there is nothing in the records to show that in recent years there is a marked decrease in the quantity of rainfall; in fact, the past five years gave us more rain than the next preceding five years; and the total precipitation for the past twenty years, from

1874 to 1894, is fully equal to the amount that fell in the two preceding decades.

The Des Moines Register recently published a letter from the Hon. Chas. W. Irish, formerly an Iowa surveyor, and now chief of the Irrigation Commission at Washington, D. C., in which is given some interesting details of the dry summer of 1846. Judging by his description that season exceeded in severity the so-called unprecedented drouth of 1894. Mr. Irish says:

I recollect very well the dry season of 1846, which took all of the surface water of Iowa away, so far as I knew it. The surface at the time was devoid of water to such an extent that none was to be had from wells, springs or streams for cattle and other stock, except in the channels of the largest streams of the state—the Des Moines, Iowa and Cedar rivers. I am unable to state personally how near being completely dried up either the Des Moines or Cedar rivers were at that time, but I can state for the Iowa river that all the water running in its channel during that summer passed through a hole two feet square, in the penstock of what was called the Company Mills, about two miles and a half above Iowa City. Not a drop of water fell during that season in our part of the country from April to November, and during all this time the weather was extremely hot. The stock of the country had to be herded along streams where water could be had for their sustenance. Plowing fields and breaking prairie had to be given up for that season, and in many cases farmers were compelled to haul water in barrels long distances in order to sustain themselves in their homes. The drouth from which we suffered in 1846 had begun in other parts of the United States one or two years previously. Two years before the New England region suffered severely, and during the years before the northern part of Ohio suffered so severely that the people along and on the southern border of Lake Erie were obliged to emigrate, for it was impossible to obtain water either for domestic or stock uses throughout a very large region of that country.

In a recent issue of the Fort Dodge Messenger, the Hon. L. S. Coffin contributed an interesting leaf from ancient weather records, showing that forty years ago, as in recent years, there was quick transition from extreme drouths to seasons of excessive rains and floods. The latter part of the season of 1854 was extremely dry, followed by a mild and dry winter and a very dry spring, so dry in fact, that one of the early settlers of Webster county drove from Muscatine to Fort Dodge, the last of April (1855), without wetting his wagon tire.

Prof. T. S. Parvin, in his notes on the climate of Iowa, said: "In 1854 occurred the great drouth in this and the western states generally, but owing to the porous nature of the soil, the crops turned out much better than in the states east of the Mississippi."

These are valuable testimonies, and it should be noted that in that early period but little of the soil had been disturbed by the plow, the aboriginal frog ponds contributed their full quota of vapor and malaria, and the little strips of forest had not been destroyed. So the great drouths of 1846 and 1854, and the intervening excessive wet season of 1851, cannot be charged to the account of man's ruthless interference with nature's methods.

In all the years from that early period to the present time, we have had variable seasons, ranging from very wet to extremely dry. The normal summer rainfall for Iowa is about thirteen inches, or an average of one inch a week for the three months. For the past twenty years the total amount has been above as often as it has been below the normal figure. This mutability of seasons is the result of a natural law, which was in operation fifty years ago as at the present time, but the secret of its working is not yet discovered.

A good many people, possessed of average intelligence, have attempted to account for this season's shortage of rainfall; but the fault of the larger number is their range of observation is too narrow, both as to time and distance. The prevalent theory which I have been reviewing was recently presented in plausible form by a correspondent of the Des Moines Register, who said: "A careful study of this problem leads unmistakably to the conclusion that the work of man in this country for the last hundred years has tended to diminish the amount of vapor in the atmosphere, and at the same time increase the temperature. \* \* \* Throughout the great central plain thousands of lakes, ponds, sloughs and marshes have been drained every year, and just so much evaporating surface has been destroyed. The cultivation of the soil by allowing the water to enter it freely has prevented the water collecting where it would be exposed directly to the sun's rays. \* \* \* In these extreme western sections the drouths have been made severe in a marked degree because by allowing the water to enter the soil, it is not evaporated so freely, and is distributed over a longer period of time, whereas if the water could be turned into vapor in a short time it would often save the growing vegetation from destruction."

Now this would fit the case most admirably if there were some fact to sustain it; but it is short on facts and long on hypothesis. There has been no perceptible decrease in the average percentage of atmospheric humidity in the summer months. The quantity of vapor is variable, but not more so than temperature, sunshine and other elements of weather.

And it is not true that cultivation of soil decreases evaporation. In fact, it can be demonstrated that breaking up the hard and well-nigh impervious prairie sod, turning under the dry and wiry grasses, stirring the soil deeply, making it both receptive and retentive of moisture and ready to yield it up for the sustenance of plants, thereby producing heavy crops in place of the scanty native herbage of the plains, serve to increase rather than decrease evaporation and humidity. The original upland prairie was hard at the surface, and measurably impervious, and the heavy rains were carried quickly into the depressions, making their way thence into the larger streams. As the result of breaking and sub-soil plowing the receptive fields absorb a much greater share of the heavy rains than formerly, and the moisture is held therein, and by capillary attraction is made available for growing plants.

The veriest neophyte in agricultural science understands that plants draw their moisture by their roots and emit it through their leaves. The more plants of deep roots and ample foliage, the more moisture is given to the air. So it follows that an acre of corn or clover yields vastly more vapor than an acre of prairie grass. And more than this, a section of land covered by general farm crops, meadows, corn fields, and well seeded and not too closely grazed pastures, will yield more moisture to the air than an equal area of lake or marsh. There is vastly more vapor arising from a dense grove than from an equal extent of water surface.

Therefore one reason why cultivation has dried up the quagmires of the olden times is because the well-tilled fields absorb and retain the moisture and yield it back to the air in the process of growing crops. There are billions more pores emitting moisture into the air in these latter years than were in operation in the olden time. The sloughs have been drained off

through the roots, trunks, stems and leaves of the plants which form the immense crops that annually burden Iowa's rich and porous soil. And a tile-drained and well cultivated field will better resist aridity, and will contribute more vapor to the air than the same soil in its original condition. So allowing that our summer rainfall depends mainly upon the local manufacture of vapor, we are in a fair way to produce more rather than less of that essential material for rainmaking.

But as a matter of fact the greater part of the humidity arising from our soil is borne eastward by the general trend of the winds, and the vapor which is condensed into rain for the watering of our fields is almost wholly an imported article, coming mainly from that vast thermal fountain, the Gulf of Mexico. Those who have closely observed the wind currents and storm movements of this midland region, realize how insignificant a drop-in-the-bucket is contributed by local evaporation to make up all our quota of rainfall.

At the time of the first geological survey of this state the total water surface, or the area of our lakes, rivers and ponds, amounted to 550 square miles, which is about 1 per cent of the area of the state. Now, if all the water in these rivers, lakes, and ponds could be drawn up into the clouds and distributed equally over the whole surface of the state, the total would not exceed half an inch of rainfall. In order to give us our average quantity of rain (which is an inch per week), the lakes, rivers and ponds would need to be filled up and emptied twice a week during the summer. The total amount of water required to give us our average summer rainfall (13 inches), would make a lake 110 miles long, 50 miles wide, and about 11 feet deep. It would require a wide expanse of frog pond to furnish sufficient vapor to fill such a lake as that. In fact, if the whole state were a vast, oozy quagmire, sizzling in the sun every day, it would not be sufficient to supply the local demand.

No; the raw material to run our Iowa rain factory is mostly imported from foreign waters, free of duty, and without cost of transportation. It is brought hither usually by the fast freight express, known as the South Wind, by the Gulf Air Line. During the past summer the southern, vapor-laden freight trains have been sidetracked, ditched, or switched off in other directions, to increase the moisture in regions already over-supplied with wetness. To them that had an abundance, more was given, and from our parched fields was taken even the little moisture remaining. We can see how it was done, but we cannot exactly understand why there was such inequality in the distribution of rainfall during the past season.

The United States Weather Bureau published a weekly weather-crop bulletin, including shaded maps showing in black and white the portions of the country wherein there was an excess or deficiency of seasonal rainfall for each week. A careful study of these maps will show where the bulk of the moisture was precipitated, and give at least a partial answer to the question why it did not rain more copiously in Iowa. The drouth began to show its effects about the middle of May, and during that month the eastern and middle states and the northwestern states were saturated, while the Mississippi and Missouri valleys were comparatively dry. In June there was a large amount of rainfall in the middle Rocky Mountain slope, and a great deficiency in the upper Mississippi valley and east gulf states.



In July there were heavy rains in the south Atlantic and east gulf states, and a general deficiency throughout the northern half of the United States, intensified in the west by the hot winds during the last week of the month. In August the drouth and hot weather covered the greater portion of the country, except the south Atlantic and gulf states, which were saturated with excess; and there were also excessive rains in western Texas, causing heavy floods in the valley of the Rio Grande.

It will be seen from this that the great deficiency in this region was in part counterbalanced by excess of rain in other sections. We may be certain that there was the usual amount of rainfall somewhere, to maintain nature's equilibrium of forces and elements.

The drouth this year was much more damaging because it was the culmination of a deficiency covering the period of nearly a full year. There was an unusual shortage in the amount of water stored up in the lower layers of the soil, from which the arable soil had been wont in other years to draw by capillarity a portion of the moisture essential to support growing crops.

The great drouth of '94 is likely to become historic, serving as a datum line for future reference and comparison. The cause was not local but general in its operation. The lack of evaporation in Iowa, or any other part of the dry area, did not affect it in the least. There were temporary changes in the general circulation of the air, whereby drier air, or descending currents became more frequent than in other seasons. There were about the usual number of cyclonic or low pressure areas (storm centers) passing above the continent, but their movements were unusually sluggish and erratic, and the greater number passed so far to the northward that they failed to draw up the valley the humid winds from the gulf. During June, July and August only two of these storm centers passed southward of Iowa—most of them hugged the Canada line. So there were not the usual reactions, and sharp contrasts of high and low temperatures, necessary to develop general or even local storms. When the gulf winds chanced to reach us, with their usual burden of humidity, the boreal breezes were not at hand to wring out the moisture by the process of dynamic cooling.

In a recent issue of the National Weather Review, Prof. Cleveland Abbe says: "If we had maps of the weather for the whole globe for every month for a long series of years we should, undoubtedly, be able to find many coincidents, so that a drouth for a given section might be predicted from the rainfall, the snowfall, the temperature, the pressure, or condition in a distant part of the globe. As a rule, important drouths or other climatic crises are the result of changes that have been going on slowly for a long time in distant parts of the earth. The general circulation of the air constitutes a complex system in which the areas of high pressure and dry, clear air are the results of slowly descending winds moving towards the equator, and the general rains are formed wherever a descending current of air, a mountain range or other obstacle has an opportunity to push up the moister air of the earth's surface. From this point of view rainy and dry, and hot and cold seasons depend largely upon the varying relations of the upper and lower currents to the continents and even to each other."

In conclusion I would say, don't be troubled about the future of Iowa. nor worried by the fear that the state is about to be desiccated. The past is the best possible guarantee for the future. We shall have wet and dry seasons in about the average number and frequency of change from one extreme to the other. By thorough drainage, subsoiling, the conservation of moisture by means of shelter belts of timber, artificial ponds and artesian or deep wells, we shall in time be able to produce abundant crops and water our stock whether the seasons shall be wet or dry.

PRECIPITATION 1894

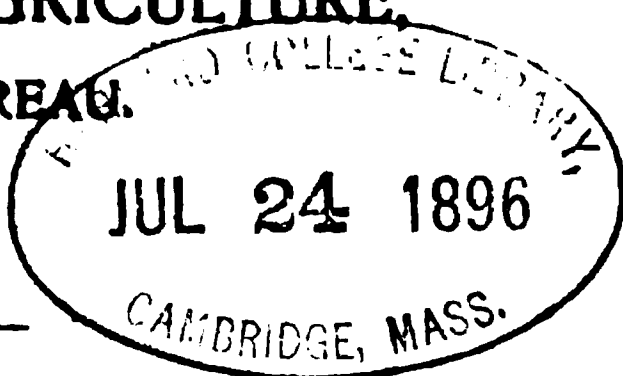






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UNITED STATES  
DEPARTMENT OF AGRICULTURE  
WEATHER BUREAU.



ANNUAL REPORT

OF THE

Iowa Weather and Crop Service

FOR THE YEAR 1895.

JOHN R. SAGE,  
*Director.*

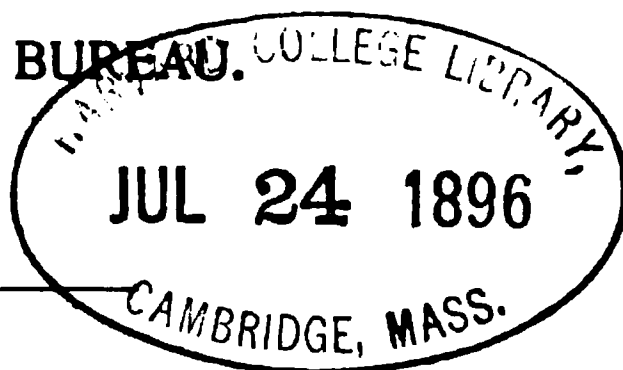
GEO. M. CHAPPEL, M. D.,  
*Local Forecast Official, U. S. Weather Bureau,  
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STATE OF IOWA,  
OFFICE OF THE IOWA WEATHER AND CROP SERVICE, }  
DES MOINES, June 1, 1896.

*To His Excellency, Francis M. Drake, Governor of Iowa:*

SIR—In accordance with the requirements of the law, we have the honor to submit herewith the sixth annual report of the Iowa Weather and Crop Service for the year 1895.

We are, sir, very respectfully,

Your obedient servants,

JOHN R. SAGE,  
*Director.*

GEO. M. CHAPPEL, M. D.,  
*Local Forecast Official, U. S. Weather Bureau,*  
*Assistant Director.*



## GENERAL REMARKS.

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Since June 1, 1890, the Iowa Weather and Crop Service has been operated under the joint auspices of the State and the United States Weather Bureau, and through this system of co-operation the best results have been secured for the benefit of all the people. The plan of co-operation has proven to be wholly feasible, and by an equitable division of labor and expense the work has been carried on with entire harmony.

The people of Iowa have come to regard it as their service, and large numbers have manifested their deep interest in the work by expressions of willingness to serve as voluntary observers and crop reporters. In fact, more proffers of service have been tendered than could be accepted, because of limited means for the equipment of stations and tabulation of reports.

A greatly increased public interest has also been manifested in the published reports of the service relating to the climatic features and crop production of this state. The tables of means and extremes, and the weather charts, are being studied by practical business men and farmers as well as by students and scientists. All classes are interested in the data and the generalizations relating to the weather and climate of this section. The subject has been a foremost topic of discussion at farmers' institutes during the past two years, and much progress has been made in popular education along this line. It has come to be regarded as a matter of practical value as well as scientific interest.

This annual report is compiled mainly from the Monthly Reviews and Weekly Weather-Crop Bulletins issued from this office, the more important data being condensed and arranged in the most convenient form for reference. The climatic records of this state will possess inestimable value to the people who will inhabit this region in the next century.

There is an increasing demand for the monthly and weekly publications issued from this office, and in their distribution the attempt has been made to subserve the interests of the general public, as well as gratify the desires of individuals. The



number of copies of the Monthly Review mailed from this office during the year was about 29,000. Summaries of the weekly Weather-Crop Bulletins, issued from April 1st to October 1st, were mailed each week to all the newspapers of the state that expressed a desire to publish them, and they were also widely disseminated through the press associations. The mailing list of the complete bulletin contained about 1,600 names. Through these various avenues of dissemination the general public was kept well informed relative to the condition of the staple crops of Iowa in the most productive season of recent years.

The meteorological data and crop statistics embodied in this report were tabulated and summarized at the central station from the reports of 104 meteorological observers, 78 weather-crop observers and about 900 crop correspondents, representing all the counties in the state.

#### DISTRIBUTION OF FORECASTS.

Daily weather forecasts are now being distributed by telegrams, postal cards and weather maps to over 800 places, reaching them in due time to be of service to the general public. They are also widely disseminated through the daily papers; and by all these various means of distribution, warnings of storms, cold waves and other notable changes of weather are placed within the reach of a very large portion of the people of this state. The cold wave warnings have been instrumental in saving perishable products of very great value.

Following is a list of stations and observers:

#### METEOROLOGICAL STATIONS AND OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Afton .....	Hon. N. W. Rowell.	Jefferson .....	Dr. Charles Enfield.
Albia (Maxon)....	Gus Johnson.	Keokuk .....	*Fred. Z. Gosewisch.
Algona .....	C. D. Pettibone.	Keosauqua .....	Prof. J. H. Landes.
Alta .....	D. E. Hadden.	Knoxville .....	Casey and Reaver.
Alta (near) .....	W. J. Minard.	Larrabee .....	H. B. Strever.
Amana .....	Conrad Schadt.	Lenox .....	J. L. Hurley.
Ames (Exp. Sta.)..	W. H. Heileman.	Logan .....	Mrs. M. B. Stern.
Atlantic .....	J. W. Love.	Madrid .....	G. B. Heath.
Atlantic .....	George W. Franklin.	Malvern .....	R. F. Norton.
Audubon .....	J. F. Hocker.	Mason City .....	H. I. Smith.
Belknap .....	A. W. Rankin.	Marshalltown...	O. M. Cook.
Belle Plaine .....	S. P. Vandike.	Mechanicsville..	Rev. J. W. Hubbard.
Bonaparte .....	Hon. B. R. Vale.	Mooar .....	F. G. Thomas.
Carroll .....	Moses Simon.	Monticello .....	Henry D. Smith.
Cedar Falls. ....	Prof. A. O. Page.	Mount Vernon...	Prof. A. Collins.
Cedar Rapids ....	H. D. Olds.	Mt. Ayr .....	H. C. Beard.
Centerville .....	Prof. H. E. Reister.	Mt. Pleasant .....	Dr. Max E. Witte.
Chariton .....	Hon. S. H. Mallory.	Neola .....	J. E. Hemsworth.
Charles City .....	J. W. Smith.	Newton .....	A. Lufkin.
Clarinda .....	A. S. Van Sandt.	Ogden .....	E. Sayre.
Clinton .....	Luke Roberts.	Omaha, Neb .....	*L. A. Welch.
College Springs..	A. A. Berry.	Osceola .....	A. W. Lewis.
Corning .....	John W. Bixby.	Ovid .....	H. C. Miller.

## METEOROLOGICAL OBSERVERS AND STATIONS.—CONTINUED.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Oresco.....	Gregory Marshall.	Osage.....	G.
Davenport.....	*F. J. Walz.	Oskaloosa.....	Jc
Delaware.....	William Ball.	Ottumwa.....	L.
Decorah.....	W. H. Baker.	Panama.....	W
Denison.....	M. E. Lee.	Portsmouth.....	T
Des Moines.....	*Geo. M. Chappel, M. D.	Postville.....	F.
Dubuque.....	*T. W. Ruete.	Pringhar.....	E.
Elkora.....	Prof. O. F. Woodward.	Rock Rapids.....	W
Elkader.....	Charles Reinecke.	Rockwell City.....	G
Emmetsburg.....	J. A. Carmichael.	Seymour.....	M
Etherville.....	M. L. Archer.	Sibley.....	H
Fairfield.....	Charles J. Fulton.	Sidney.....	G
Fayette.....	R. Z. Latimer.	Sioux City.....	*U
Ft. Madison.....	Miss L. A. McCreedy.	Sac City.....	D
Forest City.....	J. A. Peters.	South Amana.....	Jc
Galva.....	W. A. Crowley.	Spencer.....	F.
Garden Grove.....	M. Wemple.	Spirit Lake.....	W
Glenwood.....	Beth Dean.	Sutherland.....	W
Greenfield.....	J. G. Culver.	Toledo.....	Cl
Grinnell.....	Prof. S. J. Buck.	Vinton.....	T
Grundy Center.....	George F. Ellis.	Villisca.....	J
Guthrie Center.....	T. J. Foster.	Washington.....	W
Hampton.....	E. C. Grenelle.	Waterloo.....	M
Hawkeye.....	J. W. Bopp.	Waukegan.....	Jc
Hopeville.....	M. T. Ashley.	What Cheer.....	O
Humboldt.....	H. S. Wells.	Wilton Junction.....	J.
Independence.....	E. F. Wulke.	Winterset.....	W
Indianola.....	Prof. J. L. Tilton.	West Bend.....	P
Iowa City.....	Prof. A. L. Arner.	Williams.....	A
Iowa Falls.....	J. B. Parmelee.		

\* U. S. Weather Bureau.

## WEATHER CROP OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Afton.....	M. V. Ashby.	Le Mars.....	Hon. Henry Schrooten.
Agency.....	J. H. Van Zandt.	Ledyard.....	Frank Miller.
Albia.....	William Mercer.	Lawler.....	Hon. William Glattly
Alta.....	Hon. H. T. Saberson.	Lawler.....	Peter O'Bryne.
Anita.....	H. T. Chapin.	Lockridge.....	John F. Farman.
Ankeny.....	Ed. Parmenter.	Marshalltown.....	Hon. S. B. Packard.
Battle Creek.....	A. Preston.	Marshalltown.....	Hon. J. G. Brown.
Bloomfield.....	George Duffield.	Mason City.....	William Nettleton.
Boone.....	L. C. Morris.	Mapleton.....	A. Lamb.
Bristow.....	G. W. Wells.	Mount Pleasant.....	W. B. Wright.
Carson.....	G. N. Ferguson.	Milton.....	Hon. E. O. Holland.
Centerville.....	Lewis Phillips.	Mount Vernon.....	Robert Smith.
Charles City.....	W. B. Towner.	Newton.....	J. P. Beatty.
Chariton.....	O. O. Burr.	North English.....	J. L. Williams.
Clarksville.....	F. M. Russell.	Nevada.....	O. G. Ashford.
Corning.....	Jerome Smith.	Osage.....	E. W. Stacy.
Clermont.....	Charles Larrabee.	Orange City.....	H. J. Vande Waa.
Concord.....	J. M. Elder.	Paton.....	A. B. Co. dit.
Council Bluffs.....	L. Prouty.	Pittsburg.....	G. C. Duffield.
Dedham.....	J. A. Horton.	Paulina.....	Stephen Harris.
Danville.....	Sherman Matthews.	Rockwell City.....	M. W. Cooper.
Emerson.....	D. B. Nims.	Rock Rapids.....	D. E. F. Merrill.
Ely.....	Hon. A. J. Fuhrmeister.	Rossville.....	F. B. Wiley.
Fulton.....	Carl S. Frank.	Sageville.....	Hon. F. N. Knoll.
Fontanelle.....	Hon. L. M. Kilburn.	Seymour.....	J. F. Wagner.
Ford.....	J. O. Richards.	Shenandoah.....	Reuben Mullison.
Fort Dodge.....	R. W. Blain.	Spirit Lake.....	S. L. Pillsbury.
Geneva.....	William H. Thompson.	State Center.....	E. N. Thompson.
Grinnell.....	A. O. Price.	Sumner.....	John Dawson.
Guthrie Center.....	W. W. Bailey.	Tama.....	W. G. Malin.
Hesper.....	G. E. Dillingham.	Unity.....	Edw. Hummer.
Hodge.....	James Piper.	Van Horn.....	Spencer Smith.
Hamiln.....	W. P. Moore.	Wapello.....	O. P. Smith.
Humeston.....	Hon. S. H. Moore.	Wheatland.....	D. Beckman.
Independence.....	O. L. Thomas.	Willow Creek.....	W. S. Nicholson.
Indianola.....	T. B. Hammer.	Winterset.....	H. A. Kinsman.
Jefferson.....	S. M. Taylor.	Wall Lake.....	T. E. Wilcox.
Knoxville.....	B. F. Banta.	Walnut.....	F. L. Martin.
Larrabee.....	H. H. Carnahan.	What Cheer.....	O. D. Lawrence.

METEOROLOGICAL SUMMARY FOR 1895.

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*Barometer.*—The mean atmospheric pressure for the year was 30.04 inches, which is about the normal for this state. The highest reading reported was 30.93 on January 8th, at Clarinda; lowest for the year, 29.22, on April 25th, at Sioux City; range for the state, 1.71 inches.

*Temperature.*—Mean for the year, 45.5°, which is about 1° below the normal for Iowa. The highest temperature reported, 104° at Glenwood, on May 28th, and at Belle Plaine, Neola and Sidney on July 16th. The lowest temperature was 33° below zero, at Sibley on February 1st. Annual range of temperature, 137°.

*Precipitation.*—The average precipitation (rain and melted snow) for the state was 26.63 inches, about 8.25 inches below normal. The greatest daily rainfall was 6.70 inches at Guthrie Center on the 23d of August. Average number of days on which .01 of an inch or more of rain fell during the year, 70.

*Wind.*—Prevailing direction, south; highest velocity reported, 60 miles per hour from the northwest at Sioux City on the 28th of April, and at Davenport on the 7th of July. Total movement of wind, 78,657 miles.

*Weather.*—There were 169 clear days during the year, 108 partly cloudy days, and 88 cloudy days.

## MONTHLY WEATHER SUMMARY, 1895.

## JANUARY.

The mean pressure for the state was 30.13 inches; highest observed, 30.93, at Clarinda on the 8th; lowest, 20.27, at Keokuk on the 25th; range, 1.66 inches.

January was colder than the average, with less than the normal amount of precipitation. The daily mean temperature was  $13.6^{\circ}$  for the state, which is  $2.6^{\circ}$  below the normal. The highest temperature reported was  $68^{\circ}$ , at Villisca on the 20th; lowest,  $31^{\circ}$  below zero, at Elkader on the 28th. Six cold waves of considerable severity, swept across the state during the month, giving greater than the usual extremes of temperature.

The average precipitation, mainly in the form of snow, was only .85 of an inch (melted), which is .52 of an inch below the January normal.

The highest wind velocity was 54 miles per hour at Davenport on the 21st. There were 15 clear days, 9 cloudy and 7 partly cloudy.

## OBSERVERS' NOTES.

*Fort Dodge*—R. W. BLAIN: The past month has been quite cold, the temperature being below zero on 11 mornings, the lowest  $15^{\circ}$  below on the 30th. The wind blew on the 11th, 21st and 25th at a velocity of 20 to 35 miles an hour. Snow fell on 5 days, the total being about four inches. Ground frozen to a depth of two feet. Water for stock scarce. Many wells have been put down from 40 to 160 feet.

*Monticello*—HENRY D. SMITH: For the month of January the maximum temperature in 42 years was  $62^{\circ}$ , in 1855; minimum,  $33^{\circ}$  below zero, in 1883; the mean for 42 years is  $14.77^{\circ}$ . Highest precipitation in same period, 3.77 inches in 1866; lowest, .29 in 1865. Greatest amount of snowfall, 28.5 inches in 1861; normal precipitation, 1.65 inches. Thunder and lightning on the 20th and 21st.

*Keosauqua*—JOHN H. LANDES: Light thunder and lightning on the night of the 20th. Snowed all day the 25th.

*Fayette*—R. G. LATIMER: Distant thunder on the morning of the 21st. The snow is quite badly drifted and plowed ground nearly bare. Sleighing fair for light sleighs.

*Cedar Rapids*—H. D. OLDS: Heavy thunder the afternoon of the 20th and forenoon of the 21st, with some hail. Vivid lightning. An old-fashioned northeastern snow storm on the 25th, the amount of snow being 9.5 inches. The mean January temperature for 11 years is  $15.8^{\circ}$ ; highest, in 1891, was  $26^{\circ}$ ; lowest, in 1885,  $7.4^{\circ}$ .

*Clarinda*—A. S. VAN SANDT: The highest barometer of the month was 30.93 inches on the 8th; lowest, 29.50 on the 5th; mean, 30.15 inches.

*Bonaparte*—B. R. VALE: A very dry January. Only 3 inches of rainfall in 4 months.

*Delaware*—WM. BALL: Thunder and lightning on the 20th, preceded by foggy weather and followed by a rapid fall of temperature and high wind.

*Alta*—DAVID E. HADDEN: The 11th was one of the coldest days experienced in many years, with a northwest gale all day.

*Dubuque*—T. W. REUTE: Remarkably heavy thunder and sharp lightning on the night of the 20th. Heavy snow on the 25th and 26th, falling 11 inches in 36 hours.

#### FEBRUARY.

*Barometer*—Mean pressure for the month, 30.28 inches; highest observed 30.87, at Sioux City, on the 7th; lowest observed, 29.36, at Cedar Rapids, on the 20th; range for the state, 1.51 inches.

February was unusually cold and dry. The mean temperature for the state was 16.4°, which was 5.8° below the normal. The minimum temperature was below zero sixteen consecutive days—1st to 16th, inclusive. The lowest temperature reported was 33° below zero, on the 1st, at Sibley. The last week brought a marked change, with spring-like conditions, during which period considerable wheat was sown in the northern half of the state.

The average precipitation for the state was only .49 of an inch, .93 below the seasonal average. The snow disappeared before the close of the month, and nearly all of the moisture entered the soil. The number of storm days was somewhat below the average for February. The highest velocity of wind was 48 miles an hour at Sioux City, on the 20th.

#### OBSERVERS' NOTES.

*Alta*—D. E. HADDEN: High wind on the 20th from northwest, came suddenly, accompanied by dust storm, followed by rain at 5 P. M., and wind diminishing in force. Aurora on the 14th—about 7:30 P. M. to about 9 P. M. Very faint low arch. Also on the 15th—7:25 P. M. to about 10:30 P. M. Arch about 10° altitude with scattering streamers at 8:15.

*Cedar Rapids*—H. D. OLDS: Severe cold during the first part of the month, followed by milder, and during the last few days by warmer. No snow on the ground at the close of the month. The ice below the dam has gone out, but that above is still in position and is quite rotten. The melting snow has temporarily increased the water supply, but streams and wells are low.

*Sibley*—H. G. DOOLITTLE: A furious blizzard raged all day on the 6th.

*Near Atlantic*—G. W. FRANKLIN: Blizzard on the 6th and 7th. Dust storm on the 20th.

*Amana*—CONRAD SCHADT: Snow all gone by the 24th. Many fish, most of them dead, came down the river during the cold weather.

*Algona*—C. D. PETTIBONE: First appearance of geese and ducks on the 24th. Meadow larks on the 25th.

*Bonaparte*—HON. B. R. VALE: The last six days of January and the first eleven of February made a mean average of 1.3° below zero. The snow being drifted has been of no material benefit to the land in way of moisture.

*Corning*—J. W. BIXBY: Blizzard all day of the 6th.

*College Springs*—A. A. BERRY: First half of month very cold and stormy. Last half warmer. Farmers commenced plowing.

*Clarinda*—A. S. VAN SANDT: About 3 P. M. of the 6th the snow was covered by a deposit of brown dust; not from the fields here, as that would be black. Thick enough to cover the snow. Thought to be from the bad lands of Dakota. Dust storm on the 20th from the northwest.

*Denison*—M. E. LIMS: On the 17th the wind blew a gale from the northwest, with a good supply of dust.

*Elkader*—CHAS. REINECKE: Ice in the Turkey river went out at 8 P. M. on the 25th. It ranged in thickness from two to four feet.

*Humboldt*—H. S. WELLS: The last of the month was spring-like. Crows abundant. Ducks and geese plentiful.

*Keosauqua*—J. H. LANDES: From January 26th to February 17th the minimum temperature was considerably below zero.

*Larrabee*—H. B. STREVER: Noticed first flight of wild geese northward on the 22d.

*Monticello*—H. D. SMITH: 7th, trains blocked by snow. 26th, river opened. It has been closed 61 days.

*Ovid*—H. C. MILLER: Dust storms on the 17th, 20th and 27th. On the 1st a pair of robins were singing in the orchard, temperature 16° below zero; they were not seen or heard again till the 27th. The 27th and 28th were warm and spring-like and ducks, blackbirds, robins and pewees were about.

*Waterloo*—M. L. NEWTON: 15th, snow ten inches deep in the timber. 25th, the snow all gone. 26th, first appearance of spring birds. 27th, wild ducks going north.

#### MARCH.

*Barometer*.—Mean pressure for the month, 30.06 inches; highest observed, 30.55 at Cresco on the 13th; lowest observed, 29.33 at Sioux City on the 29th; range for the state, 1.22 inches.

The daily mean temperature was below normal during the first and second decades and considerably above in the closing decade of the month. The mean temperature was 34.4°, which is 2.7° above the normal for March.

The average precipitation for the state was .83 of an inch, which is 1.20 inches below the normal. The prevailing dry weather, and the high winds which are characteristic of March, caused severe and somewhat damaging dust storms on a number of days during the latter half of the month.

Highest wind velocity reported, 43 miles per hour from the south, at Sioux City on the 7th. There were 16 clear days, 7 cloudy and 8 partly cloudy.

#### OBSERVERS' NOTES.

*Algona*—C. D. PETTIBONE: 23d, 24th, 25th and 28th the worst dust storm ever seen in this section—farming operations entirely suspended.

*Alta*—D. E. HADDEN: Heavy wind and dust storm on the 21st from the south; on the 23d from the northwest all day, also on the 24th and 25th; on the 28th from the southeast all day.

*Amana*—C. SCHADT: Polar bands on the 7th and 18th. Dust storms on 23d, 24th, 25th and 28th. The dust storm of the 25th was especially remarkable.

*Cresco*—GREGORY MARSHALL: Dust storms on the 24th and 25th. The 29th was the hottest day during March on record.

*Forest City*—J. A. PETERS: A storm of sand and dust on the 24th and 25th.

*Garden Grove*—M. WEMPLE: Very severe storms of sand and dust on the 22d, 23d and 25th.

*Greenfield*—J. G. CULVER: On the 24th and 25th the atmosphere was thick with dust. Early soft maples thick with bloom. Flocks of purple greckle singing in the trees. Song sparrows and bunting occasionally seen in the prairies. 28th, first bluebirds.

*Humboldt*—HENRY S. WELLS: A good part of the wheat is sown. Too early to determine if the grass is killed.

*Iowa Falls*—J. B. PARMELEE: Wild geese seen on the 18th, bluebirds on the 26th and robins on the 27th.

*Larrabee*—H. B. STREVER: Dust storms on the 21st, 23d and 24th. Robins appeared on the 29th.

*Monticello*—H. D. SMITH: First plowing on the 26th. Oats sown on the 27th.

*Osage*—G. D. PETTINGILL: Dust storms on the 23d, 24th and 25th. The air was filled with dust continually. Enough dust was blown from the bare ground to form quite large drifts from six inches to two feet in depth along the fence rows.

*Osceola*—A. W. LEWIS: Oat sowing commenced on the 19th and was completed with ground in good condition and drouth broken.

*Ovid*—H. C. MILLER: Dust storms on the 9th, 22d, 23d, 24th, 25th and 29th. First wild geese seen on the 18th; cranes going north on the 26th and 30th; barn swallows arrived 27th; snipes seen 30th; frogs peeping 26th; grass beginning to show green 28th; lilac leaf buds open 29th; blue violets and golden rod up 29th. The driest and most dusty March ever known here.

#### APRIL.

*Barometer*.—Mean pressure for the month, 29.96 inches; highest observed 30.34 at Clarinda, on the 13th and 22d; lowest observed, 29.22 at Sioux City, on the 5th; range for the state, 1.12 inches.

The month of April was unusually warm and favorable for farm work and seeding. The mean temperature for the state as shown by the reports from 90 stations, was 54.2°, which is about 6° above the normal. At the close of the month a considerable area of corn had been planted in all the districts of the state, and some of it had germinated, showing an even stand. Some high temperatures were reported, the highest being 98° at Glenwood, on the 24th.

The average precipitation for the state was 2.62 inches, which is about the normal amount for April. It was somewhat unequally distributed, the largest amount being 5.88 inches at Guthrie Center, and the least amount, .28 of an inch at Clinton. The larger part of the state, however, received an ample amount of moisture for present needs.



The highest velocity of wind was 60 miles an hour at Sioux City, on the 28th. There were 14 clear days, 8 cloudy and 8 partly cloudy.

## OBSERVERS' NOTES.

*Bonaparte*—B. R. VALE: A most seasonable, pleasant and profitable crop month for the farmer.

*Carroll*—M. SIMON: Mr. H. Bumbower's barn in Kniest township was struck by lightning on the 29th, destroying the barn, five horses and machinery valued at \$2,000.

*Cedar Rapids*—H. D. OLDS: The ground has been in excellent condition for seeding, and the greater part of planting will have been completed by the end of the month. Fruit trees were in full bloom on the 24th, giving promise of an abundant crop.

*Monticello*—H. D. SMITH: Potatoes and peas planted in the garden on the 10th. Dust storm on the 13th. Soft maples in bloom on the 16th, cottonwoods in blossom on the 22d, and box elder blooming on the 23d. First corn planted on the 23d. Crab apples in blossom on the 27th, currants, plums, apples and gooseberries in blossom.

*Neola*—Corn planting in full blast, and all work well advanced.

*Ovid*—H. C. MILLER: Very high wind on the 29th from the south, estimated at 50 miles an hour. Sheds and stacks blown down, and orchards damaged to some extent.

*Ottumwa*—L. J. BAKER: Hail on the 6th at 12:40 P. M.; stones half an inch in diameter and lying on the ground half an inch in depth.

*Toledo*—CHAS. MASON: The rainfall from January 1st to the present time is 3.02 inches. It is remarkable that cherry, apple and plum trees are in full bloom. A great deal of corn is planted and some is up. The high temperature all the month has brought forward vegetation very rapidly.

## MAY.

*Barometer*.—Mean pressure, 29.96 inches; highest 30.39, at Clarinda on 21st; lowest 29.26, at Sioux City on 28th.

The monthly mean temperature for the state was 61.7°, which is 2° above the normal for May. It was a month of extremes, and sharp fluctuations in temperature, the range being from 94° to below the frost line. The average for the first decade was about 12° above the normal. From the 10th to the 22d, the average was about 10° below normal, and the closing week brought the temperature up again somewhat above the normal line, so that the mean for the whole month was higher than the average. There were two periods of general frosts throughout the state—11th to 14th and 19th to 22d. All sections were visited by killing frosts on one or more days, causing much damage in the aggregate to grapes, garden vegetation, corn, potatoes, rye and some other crops. By the close of the month, however, the field crops had mostly recovered their lost ground, and the conditions were then very favorable. It was an unusually good month for farm work.

The average rainfall for the state was 3.19 inches, which is about one inch below the seasonable average. There were many complaints of drouth, but they were mostly silenced by the copious showers of the 30th and 31st.



## OBSERVERS' NOTES.

*Afton*—N. W. ROWELL: Frost on night of the 11th damaging vegetables in gardens. On night of 12th another frost, inflicting serious damage to gardens and fruits. The 17-year locusts were promptly on hand June 1st.

*Amana*—C. SCHADT: Hail storm 1st and 2d; some stones large as hen's eggs, but did little damage to crops. The frost of the 14th killed grapes, corn, potatoes, rye and beans. Corn was partly replanted and all crops had about recovered at end of month. The frost annihilated the finest prospect for fruit that was ever seen here.

*Atlantic*—G. W. FRANKLIN: Freeze on 12th killed rye in bloom; also much fruit, etc.

*Belle Plaine*—H. W. VANDIKE: The month gave greatest extremes of heat and cold of which we have a record for eleven years.

*Bonaparte*—HON. B. R. VALE: The rain early in month gave vegetation a great send-off; but the freeze set back everything and especially corn, so the 1st of June finds us little in advance of May 10th.

*Chariton*—HON. S. H. MALLORY: Frost killed nearly all grapes: cut off the corn, but did not kill it. Grass is short; rye and oats good. Very little winter wheat sown.

## MAY TORNADOES.

On May 2d and 3d a cyclone of extended area passed over the upper Mississippi valley. On the 3d the center of the disturbance was near the line of North and South Dakota, and during the afternoon and evening of that day severe local storms were developed in the southeast quadrant of the cyclonic area, embracing a considerable portion of the northern half of Iowa. There were wind squalls of much force in numerous localities in this state.

The greatest loss of life and destruction of property occurred in Sioux county, where a heavy wind squall was accompanied by a small group of tornadoes of minor dimensions and considerable force, which swept a narrow pathway of desolation for a distance of over thirteen miles in a northeasterly direction. It appears probable, from the various reports, that there were two or more tornadoes developed within the belt of the storm, which varied in width from one to two miles. The storm was complex, or a combination of straight winds and an occasional descent of swiftly revolving funnels, or tornadoes. This will account for the apparent zig-zag course of the storm.

The work of destruction began in section 33, Center township, Sioux county, at about 3:20 P. M. From that point of contact the storm passed a little west of Sioux Center, and expanded its greater measure of force at or near the town of Perkins, or between that place and Hull. Beyond those points there were occasional traces of tornado action at various points, indicating alternate descent and rebound of the whirling shafts, and a general spreading out of the belt of squalls, with a gradually diminishing force.

In Osceola county, near Sibley, the effects of tornado activity were noted at a number of points within a belt of varying width, from two to three and a half miles. In that county, says the *Osceola Tribune*, "the

storm was mostly in the nature of a straight wind, with a fall of rain that amounted almost to a water spout." A number of farm residences and other buildings were wrecked in that county and one fatality occurred, Mrs. John Waltermann being killed at her home, four and a half miles west of Sibley.

At every point along the line of disturbance observers report the usual appearance of clouds coming together, from west and southeast, preceding the development of the funnel-shaped storm center. One account states that the storm cloud appeared, from a distance, like an elongated, inverted dome.

Following is an extract from the report of J. H. Sherman, of Ireton, Sioux county:

About 3 20 P. M., May 3d, dark clouds from the west were seen moving in a north, northeast direction, also a heavy cloud from southeast seemed to move in a northerly direction. The two storm centers apparently met about four miles northeast of Ireton, in Center township, at the farm of M. B. Coombs, sweeping away his barns and granaries and taking off the "L" to his house, leaving the main part standing, but unroofed. North one-half mile it struck a schoolhouse, completely destroying it, killing the teacher and injuring all of the scholars. From there it continued in a north, northeast course, sweeping away farm buildings and everything in its way. Many fine farm houses and barns were completely demolished. Fifteen people are known by the writer to have been killed, and about thirty injured, many of them fatally. Considerable live stock was also killed. Hail fell in the vicinity of Rock Valley, doing much damage, and in the west part of the county a flood of rain, sweeping away bridges, overflowing bottoms, etc.

Postmaster H. Bruins, of Sioux Center, writes as follows:

The storm, observed from its eastern side, had the aspect of a rolling, tumbling mass of clouds. From the west, an observer who saw it at a distance of 200 yards says that it looked like the regulation cyclone—funnel-shaped. On the east side the clouds seemed to dash to the earth, pass around in front of the cloud near the earth and return behind it, but near the top. The whirling could not be observed from this (east) side. The large buildings were all taken off their foundations, the northeast corner of the buildings struck the ground about 10 or 20 feet distant where they were broken up. Buildings on the eastern verge of the path were carried slightly northwest, while those on its western side were carried south or east. The storm was not accompanied by much thunder. Four or five miles east of north and the same distance west immense hailstones fell, breaking window panes, etc., but not damaging crops to a great extent.

Eight people killed outright.

Seven people fatally hurt.

Nine people hurt—legs or arms broken.

About twenty or twenty-five bruised, etc.

Those who fled into caves at the approach of the storm were not hurt. Not one who took refuge in a cellar was hurt. Pans of milk, bottles, etc., in cellars were left intact.

#### JUNE.

*Barometer.*—Mean pressure for the month, 30 inches; highest observed, 30.25 inches at Cresco, on the 25th; lowest observed, 29.60 at Sioux City, on the 24th; range for the state, .65 of an inch.

From an agricultural point of view in the larger part of the state, June was an ideal month. The mean temperature for the state was 69.7°, which is about .5° above the normal. The highest recorded temperature for the month was 102° at Neola, on the 23d; lowest, 34° at Rock Rapids, on the 27th and 28th. Light frosts were reported in various places on the 27th and 28th, but no damage to crops resulted.

The average rainfall for the state was 4.32 inches, which is about .63 of an inch below the seasonable amount. The distribution was quite unequal as it generally is at this season of the year, the bulk of the summer rainfall coming in the form of local showers. The highest amount reported was 9.26 inches at Mt. Ayr, and the minimum quantity was about .98 of an inch at Amana. In four-fifths of the state, however, the rainfall was sufficient to give sustenance to nearly all staple crops.

The wind blew 52 miles an hour at Sioux City on the 25th, from the north.

#### OBSERVERS' NOTES.

*Belle Plaine*—W. H. VANDIKE: A gale of wind occurred on the 23d; estimated velocity about 45 miles an hour. The most damage was done to shade trees, breaking off limbs where perforated by borers. On the 25th occurred the heaviest rainfall in 24 hours since September 8, 1892.

*Bonaparte*—HON. B. R. VALE: A seasonable growing month. The wind and the rain of the 17th lodged much oats, which is the only violence done crops since the freeze in May.

*College Springs*—A. A. BERRY: A splendid month for the farmers. The drouth was broken with 7.94 inches of rain for June, and 2 inches in the last two days of May, making about 10 inches in 32 days. Everything fine corn laid by in fine shape.

*Cedar Rapids*—H. D. OLDS: The rainfall on the 23d and 25th put corn and oats in good shape, but the hay crop will not exceed 65 per cent of an average. Hail did some damage in the eastern part of the county on the 25th.

*Grand Meadow*—F. L. WILLIAMS: The month was marked by very hot weather in the first part, and close to the frost line the latter part. Very little thunder with the showers.

*Garden Grove*—M. WEMPLE: June has been a great month for farmers. Everything at its best, and no one can complain.

*Neola*—J. E. HEMSWORTH: On the 17th the heaviest rainstorm of the season, with severe hail and sharp lightning. Rain washed corn badly.

*Clinton*—DR. LUKE ROBERTS: June, 1895, was one of the finest of months, and the wonderful development of flowers and foliage made the landscape beautiful, and the morning and evening rides, by those who were fortunate enough to secure them, were pleasurable and exhilarating. Considering the severe drouth of early spring and the freeze in May, the June development of products of the soil were wonderful, and fully up to the average.

It is to be regretted that this pleasing recital is not applicable to all of Clinton county. It was only the eastern portion which was visited with timely and generous rains. The total precipitation for the month was 4.68 inches, being a normal amount. At the time of the 3-inch rainfall on the 17th, only a sprinkle was deposited through the central part of the county.

*Corwith*—E. P. TREGANZA: On the 23d a hailstorm ruined crops in a strip two miles wide in sections 9 and 10, Magor township, Hancock county. In places some of the hailstones were large as goose eggs. Some pigs and chickens were killed, and trees were stripped of their leaves.

*Emerson*—D. B. NIMS: The rainfall for June was as follows: On the 2d, .41; 3d, .28; 9th, 2.20; 12th, .50; 17th, 1.50; 23d, .35; 27th, 1.00; 28th, 1.01. Total for month, 7.25 inches.

*Villisca*—J. F. MCCARTNEY: On the 14th and 23d heavy showers south-east of Villisca, with hail, damaged crops in a strip one mile wide by six or seven miles long. Wheat ruined; oats and corn badly hurt.

#### JULY.

*Barometer*.—Mean pressure for the month, 29.98 inches; highest observed, 30.32, at Clarinda, on the 10th; lowest observed, 29.55, at Cedar Rapids, on the 26th; range for the state, .77 inches.

The month of July was slightly cooler than the average, with less than the normal precipitation for the state.

The mean temperature was 72.1°, which is 2° below the normal for July. The highest temperature reported was 104°, at Neola, Belle Plaine and Sidney, on the 16th; and the lowest was 35°, at Logan, on the 9th.

The average precipitation was 3.40 inches, which is .90 of an inch below the normal. The distribution was remarkably unequal. The greatest amount reported was 10.10, at Iowa City, and the lowest amount, .45, at Neola. In some sections there were very excessive downpours on single days.

The highest wind velocity reported was 60 miles an hour, at Davenport, from the west, on the 7th.

Average number of clear days, 15; 4 cloudy and 12 partly cloudy.

#### OBSERVERS' NOTES.

*Iowa City*—PROF. A. L. ARNER: On July 18th, at 9 P. M., began a thunderstorm of unusual severity. It ceased at 3 A. M., July 19th, and in the six hours of its duration 4.67 inches of water fell. There was no violence in the storm, and no funnel-shaped cloud is reported to have been seen. The rain fell, unaccompanied by wind, in such torrents that the Iowa river raised two feet in an hour and about ten feet by the following morning. A great deal of thunder and lightning added to the fury of the elements, the latter striking twice with little or no damage within the city limits. Ralston creek, which empties into the Iowa at this place, was out of its banks so soon that the residents along it were caught in bed by the rising tide. Barns and bridges were swept away in its path. Most of the houses on the flat along Iowa avenue were flooded with water a foot or more in depth. Probably a dozen bridges in the city need more or less repairs, while the total loss to the county on bridges will amount to \$12,000. The path of the storm lies west to east, and extends about ten miles north and ten miles south of this city.

As said above, the storm itself caused no destruction; it was simply a heavy downpouring of water, not in drops, but in sheets or waves succeeding each other with great rapidity.

This is not the place to theorize on the cause of such a storm; but it may be mentioned that it was quite in the natural course of events, that is, the time was ripe for such a storm. Three and thirty-two hundredths inches of rain had fallen in the previous three days, and a temperature of from 90° to 100° maintained a steaming atmosphere. Heat and moisture the prime food of storms, were on hand in great supply.

*Bonaparte*—HON. B. R. VALE: A cool month, with 5.17 inches of rain, but well distributed over the period and accompanied by no severe winds. The earth and plants took up the moisture, leaving no excess on the surface.

*Clinton*—DR. LUKE ROBERTS: There was much thunder and lightning during the month, and especially heavy on the 7th, 14th, 18th and 26th doing some damage on the last date. Hail on the 26th did some damage, but the benefits of the heavy downpour were great. Pastures, corn and late potatoes were improved.

*College Springs*—A. A. BERRY: The storm of the 18th was the most severe ever witnessed here. Rain fell to the amount of 5.84 inches in a few hours—the heaviest rainfall on record at this station. Some damage was done. Corn will be a banner crop. Wheat two-thirds of a crop.

*Ovid*—H. C. MILLER: The storm of the 18th was very severe. Two houses were struck at Humeston, E. A. Rice's store at Corydon and A. Tolliver's barn in Clinton township. Horses and cattle were killed in fields and stacks were struck. One man was knocked senseless but no lives lost.

*Iowa*—CONRAD SCHADT: Pastures and meadows, almost burned by the drouth, have revived and grown wonderfully since the middle of the month. We need more rain. The 6.46 inches which fell in the last two weeks were entirely absorbed and the roads are again dusty.

*Primghar*—E. S. PROPER: July has been a fine month for farm products. This county will have the largest crop ever raised since its settlement.

*Toledo*—CHARLES MASON: July was very dry, with hot, sunny days and cool nights till the middle of the month, when a change took place. Showers came just in time to save the corn and potatoes. According to my records, kept for twenty-five years, we are now short in the last seven years 110 inches of the average rainfall. Our sloughs are dried out and our streams dwindled to rills. When this condition will change we can not tell.

*West Bend*—PH. DORWEILER: Harvesting finished: a light crop, but badly lodged. Two light frosts on the 9th and 10th, and hail on the 18th and 25th; damage in some localities.

#### A JULY TORNADO.

On the evening of the 26th a small tornado formed in the southeastern corner of Bremer county and passed southeasterly through a portion of Lester township in Black Hawk county, the distance traversed along the surface being about seven miles, and the width of the shaft was about thirty rods. The station at Fairbank, on the Chicago & North Western railway, was near the track of the storm, and the Fairbank View gives a graphic description, from which we make the following extracts:

Friday, July 26th, what was, probably the worst wind storm ever witnessed in these parts, passed about two and a half miles west of Fairbank. The tornado formed just the other side of Grove Hill and traveled in a general southeasterly direction, swaying to and fro like a huge serpent. It was first seen about 6 o'clock and it was almost 7 before it broke and left the ground. The distance traveled was seven or eight miles. The forward motion was very slow and anyone would have ample time to get out of the way. There was no lightning or thunder and but very little rain accompanying the tornado, but the rumbling noise which it made could be heard for miles and was

louder than the combined noise of a half-dozen ordinary thunderstorms. The cloud changed considerably in appearance during its progress. At first there was nothing especially denoting danger, being but an ordinary cloud, a little dark, but quite high. The funnel-shaped appendage which finally assumed such large proportions, seemed at first no larger than a stove pipe, and to one not in the habit of studying the clouds was no warning of the terrible fury it contained. It soon increased in size and as it came closer to the ground the bottom was black, but the top of the column, as well as the large cloud from which it hung, was about the color of smoke from an old coal fire. Everything directly in its path was destroyed. Oats, in shock, were taken up and never seen again except in the way of straws, which were scattered for miles on both sides of the tornado. Hay and grain were treated in like manner. Corn, directly in the path, appeared as if a heavy hail storm and flood had passed through. All along the side of the path for a distance of twenty or thirty rods, the corn is bent toward the tornado showing the wonderful suction power it possessed. The wire fences, not too close, have a fringe in the shape of hay and grain which caught on the barbs and fence posts. There is nothing left of fences directly in the path except badly tangled wire and broken posts.

The Cedar Falls *Gazette* also gave some interesting details of this peculiar storm, which fortunately destroyed no human lives. The *Gazette* says:

The roar which many heard last Friday evening, July 28th, came from a small tornado over in the northeast corner of this county. The home of Charles Adams, who is now in the penitentiary at Anamosa for the murder of Howard, was entirely destroyed. Mrs. Adams and the children were saved by fleeing to the cellar, but one of the little folks was slightly injured by the limb of a tree which was blown over the foundation. It is said a large hog was blown into the cellar. A barn on the Walgamothe place was blown down. Mr. Adams, Sr., who is very feeble, was on his return from a visit to his son Charles, at Anamosa, when the destruction came. They are having a full share of trouble.

Mrs. Adams, her two children and Adams' two nephews who are working the farm, took refuge in the cellar when they saw the funnel-shaped monster coming, but had been in there only a few seconds when an awful crash came and the house disappeared as if by magic. It was scattered in all directions, leaving nothing above the occupants of the cellar but the sky. The house was located in a grove of large oaks and one of these was torn out by the roots and, strange as it may appear, was deposited in the cellar, one of the roots striking one of the nephews, whose name is Monroe, and injuring him, but not seriously. Another freak, equally as strange, but with less serious results, was when, a few minutes after the tree had been deposited in the cellar a hog, weighing about 150 pounds, was also dropped down into the cellar beside the terror-stricken occupants. His hogship seemed pleased to be "in the hole," and did not grunt a single grunt, but, on the contrary, kept remarkably quiet, doing nothing more than shake his ears. The 'clone wrecked all of the barn except one stall into which two horses had been taken a few minutes before the twister came. They were left with the harness on. The aerial monster took every vestige of harness off one of them, while the other was left just as he had been when taken into the stall. Chickens had their feathers blown off, furniture was scattered in all directions, and there was a swath of twenty-five rods through the grove of oaks and adjoining timber land. One large oak was cut off about thirty feet from the ground. It stood about ten rods from Adams' house. The tornado, probably feeling sorry for what it had done, took a woman's woolen skirt and brought it down over the high stump, just as nicely as if the skirt had been spread out with hoops — making a cap to hide the damage it had done. A twelve-pound sledge hammer which was being used to drive fence posts by one of the Monroes was picked up and carried a distance of seventy-five rods and all the posts that had been driven were either torn out or broken off. A drive well pump was "driven" out of sight, and at a more rapid gait than it was ever before used to. The Adams' corn field was the next place visited, and through this a swath thirty or forty rods in width was mowed.

Two colts in the southeast part of Bremer county were taken up from the earth about 1,000 feet, until they looked like specks, then dropped and instantly killed. A large barn 64x56 feet, belonging to Mr. Bradley, was destroyed. It blew trees down on the house, wrecking the roof, but all of the family, except one boy, were in the cellar. This boy would not go into the cellar, but ran out into a field in an opposite direction



to that of the cyclone and was uninjured, as were also the other members of the family. The twister appeared to be keeping time to music from the home of the furies, for it kept going up and down. Now it would rise to a height of several hundred feet from the ground and then suddenly dart down again toward the earth, appalling all who saw it.

#### AUGUST.

*Barometer.*—Mean pressure for the month, 29.94 inches; highest observed, 30.30, at Sioux City on the 31st; lowest observed, 29.58, at Sioux City on the 8th; range for the state, .72 inches.

The month of August was unusually favorable. The mean temperature of the state was 71.9°, which is about 1° above the normal.

The average rainfall was 4.43 inches, as shown by reports from eighty-eight stations. This is .83 of an inch above the normal for the state at large. The heaviest rainfall reported for the month was 10.63 inches at Panama, Shelby county.

The crops were greatly benefited by this excess of moisture.

#### OBSERVERS' NOTES.

*Audubon*—L. P. HOCKER: On the 23d the heaviest thunderstorm known in many years passed over this station. Rain, 6.25 inches.

*Belle Plaine*—H. W. VANDIKE. I have recorded in this state forty years and have never known the soil to be so dry. Many forest trees are dying.

*Bonaparte*—HON. B. R. VALE: A royal month for threshing and saving the crop. The rains of the 23d and 28th gave us over four inches, and put the soil in excellent tilth.

*Cedar Rapids*—H. D. OLDS: Total rainfall January 1st to August 31st, 13.79 inches, which is 11.05 inches short of normal. Crops are well out of the way of frost. Water for stock is the greatest need.

*Larrabee*—H. B. STREVER: A severe hailstorm on the 9th passed a half mile east of this station, damaging crops considerably on a strip one-half to three-fourths of a mile wide and 7 to 8 miles long.

*Monticello*—H. D. SMITH: Maximum temperature for August since 1854: 99° in 1894; minimum, 36° in 1862-3. Normal for August, 70.2°. Maximum rainfall, 8.50 inches in 1885; minimum, .22 in 1889; normal, 4 inches. Total for August, 1895, 1.46 inches.

#### SEPTEMBER.

*Barometer.*—Mean pressure for the month, 29.96 inches; highest observed, 30.43, at Clarinda, on the 27th and 30th; lowest observed, 29.39, at Sioux City, on the 19th; range for the state, 1.04 inches.

The mean temperature for the state was 66.8°, which is 4.8° above the normal for September. The month will be noted for its high temperatures, especially during the second decade, there being at the central station an average daily excess of 15° from the 10th to the 21st inclusive, during which time there were but two days on which the minimum temperature was as low as the normal temperature for that period. By referring to the table of meteorological data it will be seen that ten stations in the state report the temperature as being above 100° during the second decade, and Sioux City and Glenwood reports 103° on the 17th. The month closed with a cold wave which gave killing frosts over the larger portion of the state, and temperatures below the freezing point throughout the northern half of the state.

The average rainfall for the state was 3.03 inches which is .67 of an inch below the normal for the month.

## OBSERVERS' NOTES.

*Afton*—N. W. ROWELL: Never saw it so hot in September up to 21st. Frost the 23d; no damage to crops.

*Alta*—DAVID E. HADDEN: Fifth, 8 P. M. to about 12 M. local storm with high west wind, heavy rain, some hail and sharp lightning; two horses killed by lightning. Thunderstorm on 21st from 1:15 A. M. and at intervals to about 11 A. M., also at intervals in afternoon to 7:30 P. M.; very heavy rains at intervals all day.

*Amana*—CONRAD SCHADT: Thunderstorms on the 6th, 13th, 15th, 22d and 28th. The month was very warm, especially the week ending September 21st, the mean temperature of which was 2° above the hottest week in July. Late corn had a good chance for ripening. The first frost, which was also a killing one, arrived on the last day of the month.

*Atlantic*—J. W. LOVE: Said to be the warmest September ever known up to the last week; a freeze on the 30th.

*Bonaparte*—B. R. VALE: An exceedingly warm month, but seasonable and fall crops matured perfectly.

*Madrid*—G. B. HEATH: First snowflakes noted on the 28th. First flock of ducks seen on the 27th. First ice on the 30th.

*Sac City*—DR. CALEB BROWN: Light frost—first of season—on the 25th killing frost on the 30th.

*Williams*—A. C. FULLER, JR.: Temperature on the 11th was the highest recorded since May 1st.

## OCTOBER.

*Barometer*.—Mean pressure for the month, 30.11 inches; highest observed, 30.64, at Cedar Rapids, on the 29th; lowest observed, 29.55, at Cedar Rapids, on the 26th; range for the state, 1.09 inches.

The month of October was abnormally cold and dry, with more than the average amount of sunshine and of bright, clear weather. The mean temperature for the state was 46°—3.5° below the normal for the month. The lowest temperature reported was zero, at Neola, on the 29th.

The average precipitation, as shown by the records of 89 stations, was .47 of an inch—2.38 below the October normal. Eight stations reported no measurable rainfall for the month.

The month, as a whole, was favorable for harvesting corn, potatoes and apples, but the drouth was severe on fall pasture, winter wheat and rye.

Highest velocity of wind reported, 41 miles per hour, at Sioux City, on the 18th. There were 19 clear days, 4 cloudy and 8 partly cloudy.

## OBSERVERS' NOTES.

*Ames, I. A. C.*—A. J. ASHBY: On 31st four to six shocks of earthquake were felt at about 4:20 A. M. No wind blowing. Shocks felt distinctly, and movement of furniture noted in different parts of the building.

*Cedar Rapids*—H. D. OLDS: The earthquake shocks on the 31st were distinctly felt here; apparent direction from southeast to northwest. The motion was sufficient to leave a distinct record on the thermographic sheet at a little past 5 A. M.



*Cresco*—GREGORY MARSHALL: The driest October known, with the exception of 1889, when the rainfall was .13 of an inch. Wells and springs are failing.

*Dubuque*—J. W. RUETE: A shock of earthquake was felt here on 31st, at 5:15 A. M., lasting about thirty seconds.

*Glenwood*—S. DEAN: An earthquake was felt here on 31st, at about 5 A. M. The month has been very dry and windy.

*Grinnell*—PROF. S. J. BUCK: Two slight tremors of the earth, lasting three to five seconds, separated by an interval of about ten seconds, occurred at 5:20 A. M. on the 31st.

*Iowa City*—PROF. A. L. ARNER: On the 31st, at about 5 A. M., occurred an earthquake shock lasting about one minute.

*Logan*—MRS. M. B. STERN: No rain or snow or storm of any kind during the month. Very dry and dusty.

*Marshalltown*—C. M. COOK: Earthquake felt here about 5 A. M. on 31st.

*Sidney*—G. V. SWEARINGEN: At 5:10 A. M. on 31st three shocks of earthquake were felt. There was an undulatory or swaying motion after the shocks, all lasting about one and a half minutes. On the evening of the 12th occurred the grandest display of aurora I ever witnessed.

#### NOVEMBER.

*Barometer*.—Mean pressure for the month, 30.12 inches; highest observed, 30.55 at Clarinda on the 29th; lowest observed, 29.61, at Clarinda on the 21st; range for the state, .94 inches.

The mean temperature of the month was 34.3°, which is about the normal for the state. The maximum reported was 86° at Glenwood on the 4th; minimum was 12° below zero at Williams on the 26th.

The average precipitation was 1.51 inches—.25 of an inch below normal. It was generally a favorable month for farm work.

The highest wind velocity was 37 miles per hour at Sioux City on the 5th. There were 9 clear days, 13 cloudy and 8 partly cloudy.

#### OBSERVERS' NOTES.

*Grand Meadow*—F. D. WILLIAMS: The ground frozen up very dry. Wells and springs very dry.

*Humboldt*—HENRY S. WELLS: There is some corn yet under the snow, and many ears have dropped off and will be hard to find.

*Monticello*—H. D. SMITH: Auroras on the 16th and 23d; 18th, wild geese flying southeast; 20th, Maquoketa river frozen over.

*Ovid*—H. C. MILLER: Wells, ponds and streams very low. No water running in Chariton river, or any other stream that I have seen in this county.

#### DECEMBER.

*Barometer*.—Mean pressure for the month, 30.04 inches; highest observed, 30.60 at Sioux City on the 2d; lowest observed, 29.27 at Keokuk on the 24th; range for the state, 1.33 inches.

The month of December was generally pleasant and favorable for closing the work of husking and cribbing the large corn crop. The mean temperature for the state was 25.2°, which is 1.7° below the normal.

The average precipitation for the state was 1.63 inches, which is the normal amount for December. The distribution was very unequal, the

bulk of it falling in the southeast and eastern districts, the range being from a trace to nearly 5 inches.

The highest velocity of wind reported was 43 miles an hour on the 28th at Sioux City. There were 11 clear days, 9 partly cloudy and 11 cloudy.

#### OBSERVERS' NOTES.

*Bonaparte*—B. R. VALE: This month's precipitation of 4.10 inches is unprecedented in December. In 1891 it was 2.08; in 1892, 1.89; in 1893, 1.17 and in 1894, .52. The total precipitation for the year is 31.93 inches, as against 25.81 in 1894.

*Cedar Rapids*—H. T. OLDS: Precipitation was in excess of the normal for December. The deficiency for the year still amounts to 9.65 inches, which added to that of 1894, 11.57, makes a total of 21.20 in the past two years, and seriously affects the water supply in this part of the state.

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### WEATHER AT CLINTON, 1895.

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#### ANNUAL REVIEW BY DR. LUKE ROBERTS.

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The mean temperature for 1895 was  $47.2^{\circ}$ , or  $.5^{\circ}$  above normal. The rainfall was 30.38 inches or 4.86 inches below normal. The deficiency in rainfall for the three years ending December 31, 1895, aggregates 17.38 inches. This is equal to six months of normal rainfall.

January was not over severe in its weather conditions, though the temperature was  $2.2^{\circ}$  below normal. The 28th and 30th were severely cold, with a temperature  $17^{\circ}$  below zero. The principal phenomena of the month was first, a dense fog, on the 20th, coming on early in the morning and increasing as the day advanced; this proved to be the warmest day of the month, showing a mean temperature of  $41^{\circ}$ . Second, a snow storm from the northeast on the 25th gave an average depth of 13 inches, which produced 1.35 inches of water out of the total for the month of 1.89 inches. This snow drifted badly, and seriously interfered with traffic and travel. Third, a solar halo of unusual interest prevailed all the afternoon of the 15th. Fourth, the 31st, furnished the most gorgeous sunset ever witnessed here. In addition to the intense glow which spread out in dazzling splendor a broad, colored band resting on the sun reached upward several degrees.

On the 27th very cold weather set in, lasting until the 16th of February twenty-one consecutive days with the minimum temperature below zero! This is without a recorded parallel. The nearest approach to it was in January, 1888, when for fifteen consecutive days the temperature was below zero.

After February 16th we had pleasant, comfortable weather, with only slight precipitation of snow and rain. Notwithstanding this the mean temperature was  $7.5^{\circ}$  below normal, the minimum  $5.2^{\circ}$  below normal.

There was fair sleighing from the 25th of January to the 20th of February; after this the snow rapidly disappeared.

In May, November and December there was an excess of rainfall above normal, and of less than normal in March, April, August and October. The mean temperature was below normal in the months of January, February and October, and in excess of normal in March, April, June, September, November and December.

There were clear days in excess of normal in January, February, May, August and October.

March was very dry; April, still drier, gave the least precipitation of any April on record. Grain, during these two months, had to be sown in the dust—there was not enough moisture to keep the soil from moving with the slightest breeze.

From the first day of January to the close of April only 3.92 inches of rainfall (including melted snow). The nearest approach to this minimum precipitation was the first four months of 1879, when the record was 5.37 inches.

May was more liberal in rainfall and saved the crops from total failure. Some of her storms were very severe, being accompanied with thunder and lightning and hail, notably the storm of the 7th when hard ice was precipitated with a strong northeast wind. On the 14th a freeze occurred which utterly destroyed the grape crop, seriously damaged cherries, and left a blight on almost everything green. June was one of the finest of months, and the wonderful development of flowers and foliage made the landscape beautiful. It, however, like its predecessor, opened with warmer atmosphere than it closed.

The weather condition for July averaged mild. One severe rain, hail and wind storm left some damaging marks. This occurred on the 26th between 7:30 and 8:45 P. M., precipitating 2.34 inches of water.

August was dry up to the 23d when the parched earth was revived by a rainfall of 1.44 inches. This month excelled in number of clear days. From the 17th to the 22d of September a hot spell prevailed, which puzzled weather bureau officials in making forecasts. These few days are on record as the most oppressive and enervating of all the summer months. The number of clear days exceeded those of August. The temperature from the evening of the 22d dropped rapidly, going from 87° at 2 o'clock to 52° at 9 o'clock. The next morning it was 42°. The balance of the month was cool.

October was clear, cold and dry. A damaging drouth covered large sections of country at the close of the month, and springs, wells and streams were calling for rain.

November was remarkable for the absence of sunshine and excess of humidity—conditions favorable to much sickness.

December was quite uniform and mild, and favorable to the ingathering of the corn crop which, I understand, was practically all housed as the closing year gave us its farewell salute.

#### CONSPECTUS.

Highest temperature, 99°, July 7th.

Lowest temperature, 21° below zero, February 2d and 4th.

Extreme range of temperature, 120°.

Mean daily temperature, 47.2°.

Mean daily range of temperature, 23.1°.

Greatest mean monthly range of temperature, 27.3°, in August.

Least mean monthly range of temperature, 12.5°, in December.

Greatest daily range of temperature, 46°, in March.

Least daily range of temperature, 1°, in November and December.

Warmest months, June and August; mean temperature, 72°.

Coldest month, January; mean temperature, 14.1°.

Warmest day, June 3d; mean temperature, 80.5°.

Coldest day, February 1st; mean temperature, 10.5° below zero.

Total number of days with maximum temperature 90° or above, 41; 2 in May, 9 in June, 9 in July, 12 in August 9 and in September.

Total number of days with the maximum temperature at 32° or below, 77; 25 in January, 19 in February, 14 in March, 8 in November, 11 in December.

Total number of days with the minimum temperature at or below 32°, 147; 31 in January, 26 in February, 25 in March, 4 in April, 1 in September, 15 in October, 19 in November, 28 in December.

Mean daily cloudiness, 41 per cent of the surface of the sky.

Month with greatest per cent of cloudiness, December, 66 per cent.

Month with least per cent of cloudiness, September, 24 per cent.

Total number of clear days, 157.

Total number of cloudy days, 91; 36 of these in November and December.

Month with greatest number of clear days, September, 20.

Month with least number of clear days, November and December, 7 each.

Month with greatest number of cloudy days, November.

Month with least number of cloudy days, August, 3.

#### PRECIPITATION.

Total depth of snowfall, 40 inches.

Greatest fall of snow at any one storm, 13 inches, January 25th.

Total precipitation, rain (and snow melted), 30.38 inches.

Greatest rainfall at any one storm, 3 inches, June 17th.

Month with greatest precipitation, July, 4.69 inches. June gave 4.68 inches.

Month with least precipitation, April, .28 inches.

Month with greatest number of storm days, May, 15.

Month with least number of storm days, October, 3.

Total number of storm days, 88.

#### THE WIND.

Total movement of wind, 45,090 miles.

Maximum velocity per hour, 32 miles, in January.

Greatest monthly movement, 6,450 miles, in March.

Least monthly movement, 1,750 miles, in August.

Prevailing direction, from the northwest.

Observations taken at 7 A. M., 2 P. M. and 9 P. M., show the movement of the wind to have been from the north, 82 times; from the northeast, 128 times; from the east, 75 times; from the southeast, 98 times; from the

south, 171 times; from the southwest, 176 times; from the west, 172 times; from the northwest, 198 times.

Maximum velocity for January, 32 miles an hour; for February, 20 miles; for March, 30 miles; for April, 26 miles; for May, 20 miles; for June, 18 miles; for July, 27 miles; for August, 13 miles; for September, 32 miles; for October, 27 miles; for November, 19 miles; for December, 20 miles.

SNOW AND FROST.

The last spring snow fell on the 8th day of March and only one-half of an inch.

The first snow of autumn fell on the 9th day of November and only one-half inch.

Last killing frost in the spring, May 14th.

First killing frost in autumn, September 30th.

Number of consecutive days without killing frost, 137.

The temperature of the air was at the freezing point or below for the last time in the spring on the 14th day of May. The first in autumn, September 30th.

The last day in spring when the mean daily temperature of the air was below 32°, was March 20th. The first in autumn October 29th.

ELECTRO METEORS.

Number of auroras observed, 2.

Number of days with thunder and lightning, 24.

None in January, February, April, October, November or December.

OPTICAL METEORS.

Number of lunar halos observed, 8.

Number of lunar corona observed, 3.

Number of solar halos observed, 2.

Following is a table showing the yearly mean temperature, rainfall and movement of wind for the years named:

YEARS.	Mean temperature in degrees.	Rainfall in inches and hundredths.	Wind movement in miles.
1879.....	46.7	34.18	.....
1880.....	47.1	36.18	.....
1881.....	46.2	41.17	.....
1882.....	47.8	41.18	61,460
1883.....	44.0	38.71	63,560
1884.....	45.7	43.40	54,440
1885.....	43.9	38.21	54,400
1886.....	45.6	28.71	49,260
1887.....	47.2	34.01	51,513
1888.....	45.1	35.80	56,225
1889.....	48.1	31.98	49,720
1890.....	48.6	32.62	51,890
1891.....	48.5	31.87	48,625
1892.....	46.4	40.73	43,890
1893.....	46.2	30.39	51,600
1894.....	49.8	27.57	50,040
1895.....	47.2	30.38	45,000
Sums.....	793.9	599.09	784,873
Means.....	46.7	35.24	52,491

## RIVER STATISTICS,

As furnished by Mr. Walden, of the Chicago & Northwestern railroad:

Opening of the river—ice moved very reluctantly, seeming loth to go further southward, it taking thirteen days after the first effort to release itself before it made its final departure. On March 9th, at 3:40 P. M., the ice moved, and stopped again one minute later. On the 18th it moved again at 2 P. M., and stopped again fifty-seven minutes later. It started and stopped twice on the 19th, three times on the 20th, twice on the 21st, once on the 22d, and at 10 A. M. on the 23d started again and ran out. On Monday, March 25th, at 12:10 P. M., the first boat—Denckman—passed up.

Total number of boats which passed the bridge during the season was 2,308, 1,153 of which went up and 1,155 down.

The number of barges was 467.

The number of rafts was 501.

The river closed at 8:45 A. M., December 25th, after nine months' freedom from ice.

The highest water in the Mississippi river was 14.3 feet above low water, occurring on the 30th day of May. The lowest water was only one-tenth of a foot above low water, and the date was December 4th.

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REVIEW OF THE CROP SEASON OF 1895.

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The season for the beginning of farm operations in Iowa opened about as early as in the average of recent years. During the first and second decades of March the daily mean temperature was below normal; the closing decade was warmer than the average, making the mean for the month 2.7° above the normal. The average precipitation was only .83 of an inch—1.20 inches below the March normal. The wind movement was excessive and numerous observers refer to it as the most dry, windy and dusty March ever known in their localities.

Plowing and seeding were generally begun about March 20th, with the soil exceedingly light and dry, the work being retarded by frequent dust storms. A considerable portion of the usual acreage of small grain was planted, however, during that dusty period, and the outcome of the harvest verified some of the ancient weather proverbs relative to the value of March dust.

April was unusually warm and favorable for farm work, and for the starting of vegetation, the daily mean temperature being about 6° above normal. The rainfall was about the seasonable amount, coming in light showers in weekly periods, generally sufficient for the passing needs of nearly all portions of the state, and not enough to hinder field work.

The soil was never in better condition for plowing and seeding. The sub-soil was unusually dry to a great depth; the spring rains were speedily absorbed and held near the surface. The greater part of the small grain was sown before the middle of April, the acreage being materially

increased on account of the killing out of grass roots in meadows and pastures, from the effects of drouth and winter-killing. The same cause added largely to the acreage of the corn crop. At the close of April the season was about ten days or two weeks earlier than usual.

Plowing and preparing the ground for corn was at an advanced stage, and in numerous localities a beginning had been made in corn planting before the last day of the month. It was an unusually fine spring month, and less than one-tenth of the area of the state suffered materially from drouth. Vegetation had made a fine start, pastures were well started and herds were grazing earlier than usual, and fruit trees were generally in bloom.

All these favorable conditions of temperature and moisture continued through the first decade of May. Prior to the 10th an unusually large acreage of corn had been planted, and the small grain crops had made a promising start. The average temperature of the first ten days was about 12° above the normal. The second decade, however, brought a severe and injurious change. From the 10th to the 22d the daily mean temperature was about 10° below normal. There were two periods of killing frosts throughout the state—11th to 14th and 19th to 22d. In many sections the soil was frozen and much of the early planted corn was killed, necessitating the replanting of extensive areas. Small grain, potatoes, garden truck and fruit also suffered material damage. The closing week of the month was favorable, and the field crops recovered a considerable portion of the lost ground.

June was exceptionally favorable, except in some of the extreme eastern counties where the rainfall was 3 to 4 inches below the seasonable average. In the larger part of the state it was an ideal crop month. The mean temperature was about 5° above the normal. The rainfall, 4.32 inches, was about .63 below normal; but in more than four-fifths of the state it was ample for the growing crops. At the close of the month corn was in a very promising condition, being clean and much further advanced than usual at that period of the year.

The month of July was generally favorable for harvesting hay and small grain, and in about two-thirds of the state the rainfall was ample to sustain the crops. The average precipitation, 3.40 inches, was about .90 below normal, and its distribution was very unequal. At the close of the month corn was unusually promising in two-thirds of the state, and promised a fairly good crop in the other sections. All reports indicated phenomenally heavy small grain crops, which were generally harvested earlier than usual. The crop of oats, both in respect to acreage and yield, was the largest ever grown in the state.

August was unusually favorable for bringing the bountiful crops to perfection. The temperature was slightly above normal and there was an excess of .83 of an inch in the average rainfall. Portions of the eastern and northwestern districts received less than 2 inches. Heavy rains in the latter part of the month quite widely distributed, revived the pastures and late potatoes and placed the soil in excellent condition for fall plowing.

September was noted for its high temperatures, especially during the second decade. At the central station there was an average daily excess of 15° from the 10th to the 21st inclusive. During that period there were



but two days on which the minimum temperature was as low as the normal. The average rainfall was 3.03, which is .67 below the normal for September. The month closed with a cold wave which brought the first killing frost of autumn, which extended to all parts of the state. All crops were fully matured before the frost came, and the corn was generally dry enough to put into cribs in the first week in October.

On the whole the season of 1895 was one of the most productive in the line of cereal crops that has ever been known in this state. The hay crop was cut short by the unfavorable conditions of last year; but with the great supply of corn fodder and other forage crops there will be an abundant supply of coarse food for stock and a considerable surplus for shipment. Corn, oats and potatoes are among the staples that have made the heaviest yields. In many localities the yield of oats was reported to have been phenomenally large.

And all this has been brought forth with much less than the normal amount of soil moisture at the outset, and somewhat less than the usual amount of rainfall during the season. The soil and subsoil in March contained less moisture than had ever been known at that period since the early settlement of the state. The total average rainfall for the season—March 1st to October 1st—was 21.82 inches, 3.51 inches below the normal. The monthly records for the state are as follows: March, .83; April, 2.62; May, 3.19; June, 4.32; July, 4.30; August, 3.40; September, 3.03 inches. For the most part the rains were timely, coming generally in moderate showers sufficiently frequent to save the crops from material damage. And even in the sections where the drouth was most severe the cereal crops have greatly exceeded expectations. The worst effect of the shortage of rainfall has been in cutting short the usual supply of water for stock and for domestic use.

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### THE DROUTH OF 1895.

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#### IOWA MONTHLY REVIEW FOR SEPTEMBER.

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The great drouth which began in the midsummer of 1893, has not yet relaxed its hold upon considerable portions of the country. It reached its maximum of severity in the upper Mississippi and Missouri valleys in the crop season of 1894; but for the past season its worst effects have been felt in the northern and middle states, from the Mississippi valley to the Atlantic coast. The following paragraph from the last Weather-Crop Bulletin issued by the United States Weather Bureau, briefly outlines the extent of the shortage in the seasonal rainfall:

The crop season of 1895, from March 1st to September 30th, closes with a marked deficiency in rainfall in the states northward of the Ohio river, including nearly the whole of the lake region, where the seasonal fall has generally ranged from 60 to 75 per cent of the average. Western Montana, the eastern portions of Kansas and Nebraska, southern Texas, and portions of Mississippi and western Tennessee have also received from 25 to 40 per cent less than the seasonal rainfall. On the Pacific coast there was



marked deficiency over the greater part of California, but along the coasts of Oregon and Washington it was excessive. The seasonal fall was also excessive in Georgia, South Carolina, over limited areas in Florida, Arkansas, Missouri, the Dakotas, and Minnesota, over a large part of the eastern Rocky Mountain slope from northern Texas northward to Wyoming, the percentage of excess being greatest in southern Wyoming, eastern Colorado, and northern New Mexico.

The Bulletin above referred to also contains some interesting figures showing the total deficiency in the rainfall from March 1st to October 1st, at the various weather bureau stations in the United States. These are worthy of careful study, as showing the wide extent of the drouth, and affording some facts that may help to settle the problem relative to the meteorological effects of large bodies of water and extensive areas of timber.

It appears that all the stations of the district known as the lake region, report a deficiency of rainfall. Following are the official figures:

STATIONS.	Shortage— inches.	STATIONS.	Shortage— inches.
Oswego, N. Y..	- 4.18	Lansing, Mich.....	- 9.48
Rochester, N. Y.....	- 4.04	Port Huron, Mich.....	- 4.88
Buffalo, N. Y.....	- 7.28	Alpena, Mich.....	- 9.83
Erie, Pa.....	- 5.73	Sault Ste. Marie, Mich.....	- 2.60
Cleveland, Ohio.....	- 9.80	Marquette, Mich.....	- 2.40
Sandusky, Ohio.....	- 8.88	Green Bay, Wis..	- 3.15
Toledo, Ohio.....	- 7.28	Grand Haven, Mich.....	-10.00
Detroit, Mich.....	- 8.32	Milwaukee, Wis.....	- 6.95
Duluth, Minn.....	- 5.46	Chicago, Ill.....	- 7.34

The stations in the Ohio valley and Tennessee district also show a marked shortage in rainfall:

STATIONS.	Shortage— inches.	STATIONS.	Shortage— inches.
Memphis, Tenn.....	-10.65	Indianapolis, Ind.....	-10.02
Nashville, Tenn.....	- 1.61	Cincinnati, Ohio.....	- 9.94
Chattanooga, Tenn.....	- 1.80	Columbus, Ohio.....	- 9.21
Knoxville, Tenn.....	- 6.75	Parkersburg, W. Va.....	- 9.44
Louisville, Ky .....	- 6.82	Pittsburg, Pa.....	- 7.51

Some of the Atlantic coast stations show remarkable deficiencies in the seasonal rainfall, as follows;

STATIONS.	Shortage— inches.	STATIONS.	Shortage— inches.
Eastport, Me.....	- 9.70	Washington, D. C.....	- 5.47
Boston, Mass... ..	- 7.62	Cape Henry, Va.....	- 6.70
New Haven, Conn.....	-11.00	Norfolk, Va.....	- 4.37
New York city.....	- 7.42	Charlotte, N. C.....	- 7.38
Atlantic City, N. J.....	- 8.20	Kittyhawk, N. C.....	- 9.71
Harrisburg, Pa.....	-15.84	Jupiter, Fla.....	- 4.84
Philadelphia, Pa.....	- 7.07	Key West, Fla.....	- 9.19

These figures show noteworthy fluctuations in the seasonal rainfall in the coast region, where the general conditions tend to bring excessive moisture.

The average deficiency for the upper Mississippi valley stations was 5.25 inches, the station reports showing the following shortage:

STATIONS.	Shortage— inches.	STATIONS.	Shortage— inches.
St. Paul, Minn.....	- .01	Keokuk, Iowa.....	-3.98
La Crosse, Wis.....	- 7.50	Springfield, Ill.....	-3.17
Dubuque, Iowa.....	-14.78	Cairo, Ill.....	-4.77
Davenport, Iowa.....	- 5.00	St. Louis, Mo.....	-4.65
Des Moines, Iowa .....	- 3.47		

The average deficiency in rainfall for the whole state of Iowa was 3.51 inches, as shown by the following table of monthly normals and average for the season:

MONTHS.	Normal— inches.	Rainfall, 1895— inches.	Departures— inches.
March.....	2.03	2.83	-1.20
April.....	2.60	2.62	-.02
May.....	4.15	3.19	-.96
June.....	4.95	4.32	-.63
July.....	4.30	3.40	-.90
August.....	3.60	4.43	+.83
September.....	3.70	3.03	-.67
Totals ....	25.33	21.82	-3.51

\*Above normal.

It will be seen that the total rainfall for the seven months was 21.82 inches (3.51 below normal), which was sufficient to bring the most abundant crops harvested in this state for the past twenty years And this, too, following the worst drouth experienced in this state since its early settlement.

The records for the season do not furnish a basis for some of the theories that have been so confidently broached to account for the recent widespread drouth. It will be observed that the lake regions and Atlantic coast stations suffered more than some of the western sections that have very little timber or water surface.

Evidently the notion that lakes, ponds, marshes and forests are essential to the production of rainfall is not supported by the records of the current year.

## JUNE CROP REPORT.

The season of 1895 opened unusually early, the reports indicating that it has been generally about ten days earlier than the average of former years. Farming operations were begun in March, and small grain seeding was completed generally before the middle of April. Corn planting was quite generally begun in April, and most of it came up in good time. But the killing frosts and cool weather from the 12th to the 21st of May checked the growth and necessitated a great deal of replanting. All crops suffered to some extent from the freezing temperature in May, but the greatest damage was done to grapes, garden truck and small fruit.

The summarized reports of correspondents, made June 1st, show the following results:

*Winter Wheat.*—There has been a decrease in acreage of about 3 per cent, compared with 1894, largely the result of winterkilling and plowing under for corn. This indicates a present acreage of 201,628 acres. The average condition is 82 per cent.

*Spring Wheat.*—Reports show an average decrease of 2 per cent in the acreage of this cereal. The northern counties generally report a slight increase, and the decrease is mainly in the southern and central districts. This shows a present acreage of 553,880 acres. The condition is 94 per cent.

*Corn.*—From ninety-six counties the reports show a marked increase in the acreage of corn, compared with 1894, and three counties report no increase or decrease. The average increase for the state is  $9\frac{1}{4}$  per cent, indicating an acreage of 7,380,172 acres. The condition is 95 per cent.

*Oats.*—There appears to have been an increase of 3 per cent in the acreage of oats. This would indicate a present area of 4,150,610 acres. The condition is 98 per cent.

*Rye.*—Increase, 4 per cent; present acreage, 106,075; condition, 89 per cent. A good deal of rye has been cut and cured for hay on account of damage by frost.

*Barley.*—Increase, 3 per cent; present acreage, 516,061 acres; condition, 92 per cent.

*Timothy.*—Decrease in acreage, 10 per cent; average condition, 72 per cent.

*Clover.*—Decrease, 13 per cent; condition, 69 per cent.

*Millet.*—Increase, 2 per cent; condition, 89 per cent.

*Flax.*—Decrease of acreage, 3 per cent: acreage sown, 210,136 acres; average condition, 90 per cent.

*Broom Corn.*—Decrease, 1 per cent; condition, 93 per cent.

*Irish Potatoes.*—Increase of area, 8 per cent; area planted, 124,937 acres; condition, 93 per cent.

*Sweet Potatoes.*—Increase, 1 per cent; condition, 88.

*Condition of Fruit.*—Apples, 64; pears, 58; plums, 64; peaches, 62; grapes, 30; blackberries, 57; raspberries, 55; strawberries, 49; currants, 68; cherries, 60.

*Condition of Stock.*—Cattle, 99; sheep, 98; hogs, 93; spring pigs, 88; horses, 94; foals, 71.

Meadows are rated at 69, and pastures at 80 per cent.

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### JULY CROP REPORT.

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The month of June was exceptionally favorable for all crops, except in some of the eastern counties, where the rainfall was far below the seasonable average. In about five-sixths of the state the weather was all that could be desired throughout the greater part of the month. There was not more than the usual amount of damage by severe local storms; and on the 1st of July crops were generally several points ahead of the 1st of June estimate. Following is a summary of the average condition of all the crops reported for the state:

Winter wheat, 83 per cent; spring wheat, 96; corn, 101; oats, 102; rye, 83; barley, 96; hay, 65; millet, 93; flax, 96; broom corn, 96; Irish potatoes, 103; sweet potatoes, 93; sorghum, 96; apples, 62; pears, 66; peaches, 68; grapes, 42; pastures, 89; spring pig crop, 90.

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### AUGUST CROP REPORT.

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The month of July was generally favorable for harvesting and for the advancement of the unripened crops. In about two-thirds of the state the rainfall was ample for present needs, while in the remaining portion drouthy conditions prevailed through the larger part of the month.

Corn has made material progress in the state at large. It is rated above an average condition in 61 counties, a full average in 8 counties, and below the average in 30 counties, making the average condition in the whole state 104 per cent. In the 69 counties reporting 100 per cent or over, the average is 107 per cent.

Other crops are rated as follows: Millet, 93; flax, 86; broom corn, 97; Irish potatoes, 102; sweet potatoes, 94; sorghum, 95; apples, 63; grapes, 47; buckwheat, 90; pastures, 82.

Threshing returns and estimated yield of harvested crops show the following average yields per acre: Oats, 46 bushels; wheat, 19; rye, 19; barley, 33. Hay, 1.1 tons per acre.

## DECEMBER CROP REPORT.

FINAL REPORT OF THE SEASON OF 1895, SHOWING AVERAGE YIELD AND  
MARKET PRICES DECEMBER 1ST.

Following is a summary of the tabulated reports of the correspondents of this office, showing the average yield, by counties, of the staple crops harvested in 1895; also the average prices paid at the stations nearest the farms, on December 1st. The reports of average yield have been made by a reliable class of correspondents, mostly farmers, who have had a number of years' experience as crop reporters.

The estimates of total yield for the state are made on the basis of the acreage of former years, with allowance for increase or decrease during the past season. It was hoped and expected that the returns of the state census for 1895, giving the acreage of crops, would be tabulated in time for this final report of the season; but in this we are disappointed, and the figures below are made subject to revision when the census returns are completed and available. It is believed that the acreage herein given will be found to be approximately correct.

*Wheat.*—The average yield per acre is shown to be 19 bushels, and the acreage of winter and spring is about 754,000, giving a total yield of 14,346,000 bushels. Price, 45 cents per bushel.

*Corn.*—The yield of this leading staple is exceedingly variable, depending upon local conditions as to rainfall and soil moisture at the critical stage in the growth of the crop. There is a wide range, as shown by the reports from the various counties, the lowest average being 10, and the highest 51 bushels per acre. This difference is not to be taken as an indication of a wide diversity in quality of soil or climate, but as showing the variable rainfall for a single season. The average yield of corn per acre for the state is found to be 38 bushels, and the total output, on the basis of 7,500,000 acres, is 285,000,000 bushels. The government estimates give to Iowa about 8,500,000 acres, but that is unquestionably too high. The aggregate output of corn is somewhat below the earlier estimates, but the yield per acre is sufficiently flattering to state pride, in view of the prevalent drouth, being about 5 bushels per acre above the average yield of the past twenty years. The average price December 1st was 17 cents per bushel.

*Oats.*—Average per acre for the state, 48 bushels; acreage, 4,200,000 acres; total yield, 201,600,000 bushels. Average price, 13 cents.

*Rye.*—Acreage, 106,000 acres; average per acre, 19 bushels; total yield, 2,014,000 bushels. Price, 29 cents.

*Barley.*—Acreage, 516,000 acres; average yield, 33 bushels; total, 18,678,000 bushels. Price, 24 cents.

*Timothy Seed*.—Average yield, 4 bushels per acre; total (estimated), 1,500,000 bushels. Market price, about \$1.50.

*Clover Seed*.—Yield, 2 bushels per acre; probable aggregate, about 75,000 bushels. Price, \$1.60.

*Millet Seed* —Average yield, 20 bushels per acre; acreage, unknown. Price, 45 cents.

*Flax*.—Acreage, about 210,000 acres; average per acre, 11 bushels; aggregate, 2,310,000 bushels. Price, 78 cents.

*Broom Corn*.—Average yield, nine-tenths ton per acre; estimated total, 1,500 tons.

*Irish Potatoes*.—Yield, 106 bushels per acre; probable acreage, 200,000 acres; total yield, estimated at 21,200,000 bushels. Average price, 18 cents per bushel.

*Sweet Potatoes*.—Eighty bushels per acre; total product, about 115,000 bushels. Price, 82 cents.

*Buckwheat*.—Yield, 17 bushels per acre; total product about 340,000 bushels. Price, 51 cents.

*Sorghum*.—Gallons per acre, 85; total yield, about 680,000 gallons. Price, 40 cents.

*Hay (tame)*.—Average 1½ tons per acre; estimated yield, 2,610,000 tons. Average price, \$6.25 per ton.

The average farm price of horses is \$35 per head, and cows, \$26. Wool sells at an average of 12 cents per pound. The average amount of fall plowing done is 77 per cent. The honey crop is 65 per cent of an average.

GENERAL CROP SUMMARY—1895.

PRODUCTS.	Number of acres.	Average per acre.	Total product.	Market value December 1st.
Corn .....	7,500,000	38 bushels.	285,000,000	\$ 48,500,000
Wheat .....	754,000	19 bushels.	14,346,000	6,455,700
Oats .....	4,200,000	48 bushels.	201,600,000	26,208,000
Rye .....	106,000	19 bushels.	2,014,000	584,000
Barley .....	516,000	33 bushels.	17,678,000	4,482,720
Timothy seed.....		4 bushels.	1,500,000	2,250,000
Clover seed.....		2 bushels.	75,000	845,000
Flax .....	210,000	11 bushels.	2,310,000	1,801,800
Broom corn.....		.9 ton.	1,500	90,000
Irish potatoes.....	200,000	106 bushels.	21,200,000	3,816,000
Sweet potatoes .....		80 bushels.	115,000	94,800
Buckwheat.....		17 bushels.	340,000	173,400
Hay (tame) .....		1½ tons.	2,610,000	16,312,500
Sorghum.....		85 gallons.	680,000	272,000
Prairie hay.....	Estimated..	1 ton.	1,200,000	6,000,000
Fruit.....	Estimated..			3,600,000
Vegetables.....	Estimated..			2,250,000
Pasturage .....	Estimated..			35,000,000
Corn fodder.....	Estimated..			10,000,000
Total.....				\$ 168,235,420

The above is believed to be a fairly correct estimate of the value of the soil products of this state at the minimum market prices December 1st. Of course it is understood that not more than ten per cent of the staple products of this state have been, or will be, sold at such low figures. The

greater part of these products will be consumed on the farms, or within the limits of the state, as raw material in the manufacture of beef, pork, mutton, eggs, poultry, butter, cheese, etc. In their completed marketable form these farm products will bring two or three times the amount that would be realized at the prices offered at the close of the season. We may safely, therefore, add \$100,000,000 to the above total as the probable increment of value from feeding or holding for better prices.

COUNTY.	AVERAGE YIELD PER ACRE BY COUNTIES.													
	Winter wheat, bu.	Spring wheat, bu.	Corn, bu.	Oats, bu.	Rye, bu.	Barley, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed, bu.	...	...	Sweet potato's, bu.	Sorghum, gals.	Buckwheat, bu.
Adair	24	32	46	62	20	32	6.4	2.6	28	8	1.5	128	100	14
Adams	14	...	47	52	8	...	5.0	...	...	...	...	112	...	1.4
Allamakee	18	16	31	40	18	35	4.8	1.8	10	12	...	63	48	1.5
Appanoose	15	...	33	40	15	...	3.5	...	...	...	...	50	100	1.5
Audubon	20	27	36	58	20	39	4.7	1.0	8	...	...	84	100	1.4
Benton	...	16	36	58	18	25	2.6	...	...	...	...	140	...	1.5
Black Hawk	...	...	35	44	17	33	3.0	2.2	15	16	...	101	75	1.3
Boone	...	25	60	60	21	35	4.7	1.4	20	...	...	129	102	1.7
Bremer	...	12	20	40	18	...	4.5	...	12	12	...	47	60	1.2
Buchanan	20	16	30	45	16	...	2.0	1.5	...	...	...	110	60	1.2
Buena Vista	...	24	32	55	18	41	2.6	...	30	9	...	74	40	...
Butler	...	16	31	42	16	45	4.3	...	12	8	...	85	120	1.4
Calhoun	...	25	45	60	23	50	5.7	2.5	52	11	...	158	50	1.6
Carroll	24	25	38	56	21	32	3.0	2.0	27	11	...	137	20	1.4
Cass	19	23	38	47	18	27	3.0	1.8	17	...	...	84	75	1.4
Cedar	15	14	40	33	15	21	3.3	1.3	...	...	...	82	100	1.3
Cerro Gordo	...	16	38	46	18	27	1.8	2.0	10	11	...	115	100	1.2
Cherokee	...	26	39	58	18	48	4.6	2.0	...	10	...	89	...	1.6
Chickasaw	...	15	39	49	19	37	4.1	...	...	14	...	104	70	1.3
Clarke	20	18	42	47	19	25	4.1	1.6	35	...	2.0	126	100	1.3
Clay	...	15	10	26	...	36	3.0	...	...	5	...	20	...	...
Clayton	16	13	32	47	17	23	3.2	2.0	...	...	...	84	95	1.6
Clinton	20	15	32	33	25	...	...	...	...	...	...	50	...	...
Crawford	...	19	36	25	16	20	2.0	...	22	...	...	150	100	1.3
Dallas	24	20	50	59	31	40	4.6	2.4	18	10	...	111	100	1.9
Davis	18	13	47	44	17	...	3.7	1.8	...	...	...	90	82	1.0
Decatur	21	16	48	49	19	...	4.7	2.0	19	6	...	123	80	1.6
Delaware	20	14	25	27	14	20	3.8	...	8	...	...	63	80	1.2
Des Moines	18	8	40	32	19	...	3.1	2.2	...	...	...	69	70	1.3
Dickinson	...	19	10	30	18	23	2.0	...	...	7	...	62	20	...
Dubuque	11	10	23	22	14	20	1.5	2.0	...	...	...	70	45	...
Emmet	...	21	22	45	20	32	3.3	...	6	7	...	147	30	1.1
Fayette	16	15	35	43	26	33	4.8	1.8	14	12	...	104	100	1.1
Floyd	...	19	36	44	18	32	3.4	2.0	14	11	...	118	81	1.0
Franklin	...	23	48	53	26	37	3.2	1.0	22	13	...	128	90	1.2
Fremont	23	18	50	46	23	26	5.6	2.0	6	9	...	142	225	1.8
Greene	25	20	42	52	16	15	5.0	2.5	20	7	...	162	50	1.6
Grundy	...	21	41	49	29	41	5.5	...	...	10	...	121	50	1.9
Guthrie	25	21	43	57	22	42	5.0	2.9	15	9	...	117	75	1.7
Hamilton	...	23	47	65	26	37	4.5	2.0	18	10	...	156	100	1.7
Hancock	...	20	46	49	23	33	4.6	2.0	20	13	...	90	...	1.3
Hardin	20	21	43	50	21	42	4.0	1.6	16	9	...	94	30	1.5
Harrison	...	22	37	43	20	32	...	...	15	...	...	93	50	1.2
Henry	23	16	51	40	22	...	2.6	1.5	4	...	...	106	65	1.5
Howard	18	17	43	50	20	34	4.1	1.8	14	14	...	131	70	1.4
Humboldt	...	23	40	50	24	30	4.0	3.0	18	14	...	128	90	1.1
Ida	...	20	33	41	11	23	2.5	...	8	...	...	150	90	1.3
Iowa	19	17	36	23	20	24	3.7	2.5	...	...	...	74	100	1.6
Jackson	16	14	30	29	12	20	4.0	1.5	7	...	...	55	75	1.7
Jasper	21	16	47	51	19	24	3.6	2.4	20	10	...	122	50	1.5
Jefferson	19	12	43	39	16	...	3.0	1.7	14	...	...	111	60	1.3
Johnson	19	16	50	40	18	23	2.4	1.8	12	...	...	144	100	1.8
Jones	...	15	37	42	20	29	3.3	1.2	...	...	...	89	72	1.0
Keokuk	19	15	49	45	20	...	3.2	...	...	...	...	75	90	1.1
Kossuth	...	20	42	55	25	42	5.0	6.0	22	14	...	125	175	1.0
Lee	16	...	37	37	16	...	4.4	1.5	5	...	2.0	72	68	1.3
Linn	10	14	30	31	17	35	5.0	2.0	...	...	...	108	88	1.4



COUNTY.	AVERAGE YIELD PER ACRE BY COUNTIES.															
	Winter wheat, bu.	Spring wheat, bu.	Corn, bu.	Oats, bu.	Rye, bu.	Barley, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed, bu.	Flax seed, bu.	Broom corn, tons.	Irish potat'es, bu.	Sweet potat's, bu.	Sorghum, gals.	Buckwheat, bu.	Hay, tons.
Louisa.....	20	...	38	28	12	...	2.0	...	...	...	...	75	40	88	...	1.8
Lucas.....	22	...	43	45	22	...	3.6	3.0	20	10	...	124	65	82	22	1.8
Lyon.....	...	23	28	51	35	42	6.0	...	...	13	...	100	...	...	...	1.3
Madison.....	16	17	37	54	19	50	5.2	2.0	...	8	...	87	120	93	12	1.0
Mahaska.....	21	16	41	46	16	...	5.0	3.0	15	...	...	65	60	...	...	.9
Marion.....	18	18	39	42	19	80	2.7	1.2	14	...	.2	70	60	82	17	1.2
Marshall.....	20	23	36	48	21	37	2.8	1.2	20	9	...	113	...	130	...	1.5
Mills.....	22	19	43	48	20	28	4.7	2.1	20	...	...	109	112	92	...	1.7
Mitchell.....	18	16	40	46	20	35	4.6	2.2	23	15	...	134	...	85	21	1.2
Monona.....	...	21	32	39	21	30	...	...	19	...	...	114	150	83	...	1.3
Monroe.....	23	...	40	34	16	...	3.6	2.0	18	...	...	124	136	108	14	1.0
Montgomery.....	20	21	48	61	14	30	5.7	2.5	...	...	.5	69	...	...	11	1.4
Muscatine.....	23	23	44	36	14	...	2.0	4.0	...	...	...	120	78	75	...	.9
O'Brien.....	...	20	28	60	15	35	5.0	...	...	10	...	133	...	...	...	1.2
Osceola.....	...	24	22	55	...	38	4.5	...	...	10	...	77	...	...	...	1.0
Page.....	16	13	47	49	15	46	6.7	2.0	45	...	...	104	120	100	...	1.9
Palo Alto.....	...	23	23	45	15	22	3.7	...	20	9	...	59	...	50	...	1.0
Plymouth.....	...	23	22	50	15	40	7.0	1.5	40	...	...	100	...	85	...	1.5
Pocahontas.....	...	21	26	57	18	39	3.9	2.2	46	10	...	104	...	78	19	1.2
Polk.....	22	23	42	50	22	...	4.0	2.3	17	10	.2	80	50	83	20	1.4
Pottawattamie..	18	22	37	50	16	27	3.1	2.0	30	...	...	120	74	96	...	1.3
Poweshiek.....	15	18	41	45	19	34	3.3	1.8	...	...	...	120	65	75	...	1.2
Ringgold.....	17	13	46	47	16	34	3.8	1.8	24	...	...	155	116	106	17	1.5
Sac.....	15	19	38	52	17	39	4.5	...	38	10	...	110	...	50	30	1.0
Scott.....	15	14	33	24	14	16	3.2	2.2	12	...	...	104	60	75	17	.5
Shelby.....	...	21	30	44	14	33	2.5	1.5	...	...	...	95	...	50	...	1.2
Sioux.....	...	27	37	56	22	46	4.1	1.5	30	13	...	111	...	...	...	1.7
Story.....	...	21	47	57	25	41	3.9	1.9	42	10	...	132	55	80	15	1.5
Tama.....	25	22	37	46	25	35	5.1	2.9	21	...	...	122	75	171	...	1.4
Taylor.....	12	14	44	46	14	...	4.4	2.1	20	...	...	94	...	90	10	1.6
Union.....	13	15	47	55	15	...	5.2	2.0	5	...	...	142	78	97	...	1.4
Van Buren.....	23	...	46	45	18	...	4.0	1.9	20	...	...	149	58	90	19	1.4
Wapello.....	20	18	43	43	19	...	4.0	2.7	10	...	...	97	45	63	.8	1.1
Warren.....	20	20	44	45	20	30	3.7	2.4	19	...	.3	92	62	81	18	1.4
Washington.....	23	...	45	40	14	...	3.0	1.3	...	...	...	91	60	98	...	.8
Wayne.....	17	14	45	47	19	...	4.2	2.0	23	8	...	133	62	89	19	1.6
Webster.....	...	20	46	53	24	34	3.7	1.2	19	10	.8	113	...	103	12	1.7
Winnebago.....	...	27	46	59	...	50	6.0	...	35	13	3.0	156	...	100	...	1.6
Winneshiek.....	12	19	30	48	19	34	3.9	1.9	15	13	...	102	...	98	10	1.2
Woodbury.....	15	18	32	37	12	23	3.0	...	16	8	...	90	...	50	20	1.5
Worth.....	...	20	47	51	33	30	4.7	2.3	...	12	...	117	...	...	16	1.2
Wright.....	...	25	46	58	24	36	5.4	2.5	20	12	...	107	...	100	16	1.4
Averages.....	19	19	38	48	19	33	4.0	2.0	20	11	.9	106	80	85	17	1½

WEATHER CROP BULLETINS.

SUMMARIES OF WEEKLY BULLETINS FOR THE CROP SEASON OF 1895.

BULLETIN NO. 1, APRIL 9TH.

The season has opened about as early as in the average of the past ten years. The temperature has been about normal since the middle of March, with less than the seasonable amount of precipitation during that month.

The first week of April began and ended with refreshing showers, giving something over an inch of rainfall to the larger part of the state. This has been speedily absorbed by the dry soil, causing but slight hindrance to farm work.

The soil has never been in better condition for plowing and seeding, and the work is generally at an advanced stage.



There has been sufficient moisture to facilitate farm operations, and not enough to obstruct the work. The bulk of small grain has been sown in the larger part of the state.

Grass has made a seasonable growth since April 1st. Some meadows and pastures show the serious effects of the extended drouth, and this will probably result in plowing up a considerable area of grass lands, to be planted in other crops.

Live stock has been wintered in good condition and the supply of forage is generally sufficient to feed till the pastures will yield a support.

There are no reports of serious damage to fruit.

BULLETIN NO. 2, APRIL 16TH.

The first half of April has given a bright hue to crop prospects, and at the corresponding date there has never been a more encouraging outlook for a productive season.

The temperature of the past week was slightly above normal, and all the weather conditions were favorable for completing seeding operations and pushing the work of preparation for corn planting.

As a result, farm work is generally more advanced than usual at this time of the year, and the soil is in the best possible condition for the reception of seed.

The acreage of small grain, corn and potatoes will be materially increased, compared with the last three seasons.

The week closed with a general rain, giving promise of abundant moisture for present needs in all parts of the state.

All reports indicate a good season for fruit.

BULLETIN NO. 3, APRIL 23D.

There has been a continuation of favorable weather conditions in the past week. The daily mean temperature has been about normal, the days being generally warm and the nights cool, with occasional light frosts.

The rainfall has been ample for present needs in the larger part of the state. Reports of continued drouthy conditions come from some of the northern and northeastern counties; but crops therein have not as yet suffered material injury.

Rapid progress has been made in farm work. The acreage of small grain is large, and more than the usual area of land has been plowed for corn. In some districts a beginning has been made in planting, and with favorable weather it will be quite general by the first of May.

Early sowed cereals are well sprouted and show an excellent stand. Pastures are quite forward, in some sections affording an ample support for stock.

Fruit buds have not been materially injured by frost.

BULLETIN NO. 4, APRIL 30TH.

The past week has been very warm, the daily mean temperature being about 8° above normal.

A heavy local shower on Friday, covering a few counties in the central and western districts, and more general rains on Monday, have given to the larger part of the state a much needed supply of moisture. The drouth had become quite severe in some of the northern and eastern counties.

The conditions have been favorable for pushing farm work. In all districts a fair start has been made in corn planting, with the soil in fine tilth. The area prepared for planting is unusually large.

All reports indicate a fine stand of small grain. The condition of winter wheat and rye is also reported good.

The hay crop will be very light, even under the most favorable conditions in the future. And pasturage will also be scant on account of the effects of the drouth and winter-killing.

The season is fully ten days earlier than the average of former years.

BULLETIN NO. 5, MAY 7TH.

The past week has been unseasonably warm, with frequent and copious showers. The daily average temperature ranged 10° to 12° above the normal, and every district reports rainfall from one to three inches.

All crops have received great benefit from this excess of heat and moisture. Corn planting has been delayed by the showers, but it is well advanced in all parts of the state. In the early planted fields corn is well started, showing a fine stand; and in some sections the work of cultivation is begun. All reports indicate a considerable increase of corn acreage.

In some sections cut and wire worms have begun their ravages at an unusually early date, and in a small area chinch bugs are reported at work in the rye fields.

All small grain crops are unusually promising. Pastures and meadows show vigorous growth, where the plants have not been winter-killed or burned out by the drouth. All the forces of nature seem to be doing their best to repair damages of the past year.

The wind storms of May 3d in the northwest district developed local tornadoes, with destruction of life and buildings. No material damage to crops reported.

BULLETIN NO. 6, MAY 14TH.

This has been a week of notable extremes of temperature, the mercury dropping suddenly from 94° to the frost line. The daily mean of the first three days was about 15° above normal; the last three days, 10° below normal.

Frosts were general and in some sections quite destructive to tender vegetation, on the morning of the 12th. Garden truck, potatoes, small fruit and grape vines were severely injured in all exposed localities. No reports have been received of material damage to field crops, except potatoes, and they will probably recover. The corn crop is all right.

Corn planting is practically completed, except in sections where it was retarded by frequent showers and excessive moisture. The work of cultivation is now quite general and a good stand has been obtained.

Small grain and grass have made good advancement. On the whole, the outlook for the staple crops is still very flattering.

BULLETIN NO. 7, MAY 21ST.

The past week was unseasonably cold, and generally dry. The daily mean temperature was about 8° below normal. The rainfall was very light, except in some of the northeastern counties.

The rapid growth of vegetation has received a most decided check, and little progress has been noted during the past ten days. Reports indicate

that the heaviest damage by the recent frosts was suffered in the east central and northeast districts. The damage to small grain has been relatively light, and it seems probable that the incidental benefit resulting from checking the too rank growth of spring grain will fully compensate for the injury by the freezing temperature.

With favorable conditions in the future there is ample time for the corn crop to fully recover its lost ground. The only irreparable injury has been suffered by grapes, berries and some other kinds of fruit. The bulk of damage to all other crops can be repaired, if there is ample warmth and moisture in the near future.

BULLETIN NO. 8, MAY 28TH.

The past week has been dry and cold, with occasional light frosts. The daily mean temperature was about 4° below the normal, and there was but little more than a trace of rainfall in the larger part of the state.

Despite these adverse weather conditions, the spring grain crops are generally doing fairly well. Some progress has been noted in recovery from effects of recent frosts. The corn crop is a little more than holding its own in the conflict with cold weather and cut worms. Considerable replanting has been reported, and planting operations will continue until after June 1st, assuring a large increase in the acreage.

In numerous localities fall rye was blighted by freezing temperature, and it is being cut for fodder. The damage to fall wheat has not been extensive.

Pastures and meadows have materially suffered from lack of rain. The hay crop must necessarily be light.

BULLETIN NO. 9, JUNE 4TH.

The past week witnessed a remarkable transition in the condition of crops, and in the hopes of the people. The daily mean temperature for the week ending June 3d was about 10° above normal. The high and hot winds of the 27th and 28th, which threatened serious damage to all crops, brought copious and well distributed rainfall on the 30th, with local showers on June 1st, 2d and 3d, affording abundant moisture to nearly all parts of the state.

The result has been a notable transformation in the appearance of all vegetation. Corn has made rapid progress in recovery from its setback by cold weather and the cut worms. The damage has been mainly repaired by replanting, and most reports show that a good stand has been obtained, with about an average condition.

Oats and other small grain are doing well. Potatoes are now quite promising. Pastures and meadows show some improvement.

BULLETIN NO. 10, JUNE 11TH.

Warm, growing weather prevailed during the past week. The average daily temperature was about 2° above normal. The rainfall was generally light until Sunday, on which day heavy showers passed through the central districts from southwest to northeast, giving ample rainfall for present needs to at least three-fourths of the area of the state. In some localities the showers were phenomenally heavy, and possibly occasioned

some damage to crops by washing and covering; but the rains, on the whole, have been highly beneficial to all crops.

Corn is now generally in clean condition and shows a good stand, giving promise of a large crop with favorable conditions in the future.

Oats, barley, spring wheat, potatoes and flax are generally reported in good condition. Pastures are improving. Small fruits are doing better than was expected.

BULLETIN NO. 11, JUNE 18TH.

The general weather conditions during the past week were favorable in the larger part of the state. The daily mean temperature has been slightly above the normal. The reports for the week ending the 15th show a very unequal distribution of rainfall. In the central belt, south to north, the measurements range from 2 to 5.75 inches. In a number of the counties in the east central and southeast drouth has practically remained unbroken, and all crops except corn have been considerably injured by its continuance.

But in nine-tenths of the state the conditions have been about as good as could be desired, and all crops have made rapid advancement. Corn is doing notably well in all sections, and has been thoroughly tilled except in localities where cultivation was retarded by very heavy rainfall. This crop has gained several points since June 1st, and is now quite promising. Spring grain crops are heading in fine shape. The harvest of winter grain will begin in some of the southern counties during the coming week.

BULLETIN NO. 12, JUNE 25TH.

This has been one of the best weeks of a most propitious season, with weather conditions all that could be desired over the greater part of the state. The average temperature has been about normal. The amount of rainfall has been generally ample for the present needs of growing crops. The only complaints on that score have been an excess of moisture, causing too rank growth of grain, in the northwest; and a deficiency of rainfall in some of the eastern counties.

All crops have made good progress. Corn has attained more than an average height for the season. In some fields it is reported too large to cultivate within thirty days after planting.

Oats are in full head and harvest of the earliest fields will begin within two weeks. The present condition of this cereal justifies the promise of the largest crop of oats ever harvested in this state.

Other spring grain crops are also in good condition.

The harvest of fall wheat and rye is in progress in the southern districts and the yield of wheat promises to be better than was anticipated.

BULLETIN NO. 13, JULY 2D.

The daily temperature of the past week averaged about 3° below the normal, and there was a general deficiency of sunshine. The rainfall was abundant, except in portions of the eastern districts.

On the whole the cool weather has been highly favorable for oats, spring wheat and flax, and not detrimental to other crops. Oats are filling well, and the more advanced fields will be ready for harvest within a week. The only drawback to the crop is too rank growth of straw on rich soil, where the rainfall has been copious.

Reports show an increased acreage and a full normal condition of flax in the sections where it is most largely grown.

Corn is thriving and the larger part of it will be laid by in fine condition before the 4th.

Haying is in progress. There has been a notable improvement in meadows within the past eight days in the larger part of the state, and the yield may be slightly above half an average crop. Prairie hay will be heavier, and pastures are generally good.

Potatoes are exceptionally promising.

#### BULLETIN NO. 14, JULY 9TH.

The daily mean temperature of the week ending the 8th, was slightly above the seasonable average. The rainfall was generally deficient, the southwest district receiving the larger quantity on the 4th inst. On the 7th light showers afforded some relief to the eastern districts which have suffered material injury from the protracted drouths.

In the larger part of the state crops have made rapid progress and are in a very satisfactory condition. Corn is above an average in nearly all sections.

Oats are everywhere putting on the harvest color, and cutting is already in progress in the earlier fields. The crop as a whole will be somewhat lessened by too rank growth and lodging, but with favorable harvest weather the prospect is still good for the greatest total yield ever grown in this state.

All field crops except hay are doing remarkably well, and in sections favored by heavy showers the yield of hay has exceeded expectations. Flax promises an average crop in sections where it is most extensively grown.

#### BULLETIN NO. 15, JULY 16TH.

The daily mean temperature of the past week was about 6° below normal, and the farmers of the state had six days of dry and cool weather for working in harvest fields.

In the northern districts a light frost on the morning of the 9th slightly damaged garden truck and corn on bottom lands, but it will not materially lessen the crops.

Reports mailed before the 14th indicated drouthy conditions in nearly all districts, and in the eastern counties the small grain and grass crops have been materially injured by the protracted drouth.

The copious showers of Saturday night and Sunday afforded substantial relief in many localities from which later reports have been received, and it is believed that the larger part of the state received some measure of benefit from these timely rains.

The harvest of winter grain and barley is practically completed, with fairly satisfactory results, and the oats harvest is well under way in all sections.

Corn is generally doing well in all districts, and in the most favored sections it has reached the tasseling and earing stage. Potatoes and the minor crops are in fair condition.

## BULLETIN NO. 16, JULY 23D.

The temperature of the past week was about the seasonable average. For a mid-summer week the rainfall was phenomenally heavy, the measurements reported from more than two-thirds of the state ranging from two to five inches. Some of the heaviest showers fell in the districts that had suffered most severely from drouth, and there is now only a very small area that has not received ample moisture for present needs.

In many localities the unharvested crops of small grain were prostrated by the winds and weight of rainfall. In a few sections considerable loss resulted from hailstorms within narrow belts. On the whole the benefits have been immeasurable and the aggregate of loss relatively small.

The harvest of oats is in progress, and nearing completion in all districts. Scattering returns from threshers show high average yields of winter wheat, barley and oats.

Corn and potatoes maintain their promising condition.

## BULLETIN NO. 17, JULY 30TH.

The average temperature of the past week was about normal. Nearly all sections of the state have had sufficient rainfall for present needs, and considerable damage has been caused by severe local storms, accompanied by wind and hail.

On the whole, however, the week has been highly favorable for the growing crops, and for harvesting and threshing the ripened small grain. The oats harvest is about completed and threshing is in progress, with many reports of phenomenally heavy yields. The cutting of spring wheat is in progress, and some early fields of flax are ready for harvest.

Corn is steadily maintaining its lead and bids fair to break all previous records in the districts where the rainfall has been ample. Potatoes and the minor crops are doing well.

## BULLETIN NO. 18, AUGUST 6TH.

The average daily temperature of the past week was slightly above normal, and the rainfall was generally deficient. The weather conditions have been favorable for completing the harvest of small grain, and for threshing from fields, which is in progress with highly satisfactory returns.

Nearly all threshing reports show the yield of oats to be phenomenally heavy, and barley and wheat above the average.

A special report from 640 correspondents, representing every county in the state, shows that the condition of corn is considerably above an average in sixty-one counties, a full average in eight counties, and somewhat below the average in thirty counties. For the state at large the condition is materially above an average. The earlier fields are in the roasting ear stage, and with favorable weather the bulk of the crop should be beyond danger of frost before the middle of September.

The flax harvest is in progress. Potatoes are doing well in nearly all sections.

## BULLETIN NO. 19, AUGUST 13TH.

The average temperature for the past week was above normal. On the 8th and 9th brisk winds, with the temperature above 90°, caused apprehension of serious damage to the rapidly maturing corn crop. This was



relieved in part by the cooler weather, with scattered showers in the western and northern districts. The amount of rainfall was sufficient to afford substantial benefit to crops in about one-third of the state, mainly in the northern districts.

In more than half of the state corn has unquestionably received some measure of damage from hot and dry weather since the first of August, and the present condition does not justify the promise of more than an average yield for the state at large. Reports show the condition to be very uneven, as a result of the notable variability of the rainfall. With timely rains to help out the later fields and favorable weather throughout the balance of the season the total output of corn will be highly satisfactory.

Threshing returns continue to show yields of oats much above the average, and other small grains unusually heavy.

BULLETIN NO. 20, AUGUST 20TH.

The temperature of the past week was above the seasonable average, and it was generally dry. The rainfall was in form of light local showers, covering a small area of the state.

Reports from the cornfields are unusually variable, being largely colored by local conditions as to rainfall and conditions of the soil. Late planted corn, on naturally dry land, has suffered material damage from effects of drouth. Early planted corn, especially on bottom lands, is maturing in good shape and much of it will be ripe enough to cut within a week.

With timely rains to develop the late planting, this state will probably produce a fair average crop of corn. If the weather remains dry and hot, pushing the crop too rapidly to maturity, the quantity and quality will be reduced considerably below the normal yield. But without another drop of rain for a month the aggregate of corn will most likely be more than double the output of last year.

Pastures and late potatoes need more rain.

Threshing returns indicate notably heavy yield of timothy seed. Oats yield far beyond any former record, and all small grains are exceptionally good.

BULLETIN NO. 21, AUGUST 27TH.

The mean temperature of the past week was slightly above the normal. On the 22d and 23d heavy and widely distributed showers afforded relief from the prevailing drouth. Excessive measurements of rainfall are reported from all sections, except a few northwestern counties. Following are some of the heavier amounts reported: Chickasaw, 6.50 inches; Hamilton, 8.50; Shelby, 6.47; Guthrie, 6.70; Harrison, 5.40; Pottawattamie, 3.40; Adair, 3.25; Scott, 4.36; Fayette, 4.35; Clayton, 2.87; Muscatine, 2.15; Monroe, 2.35; Davis, 2.55; Polk, 2.19; Wayne, 2.50; Webster, 2.19 inches.

The soil is now in excellent condition for fall plowing, which is in progress. Pastures have been revived; late potatoes and corn are now placed beyond danger of further injury by drouth, and they will make the most of their improved conditions.

BULLETIN NO. 22, SEPTEMBER 3D.

The mean temperature of the past week was slightly above normal. The rainfall was ample in all parts of the state, and in numerous localities

it was in excess of the normal. From a few sections reports are received of damage by washing and local floods.

On the whole the week has been exceedingly favorable for ripening late corn and potatoes and for the growth of grass. Cutting early-planted corn is in progress in all districts, and the larger portion of the crop is now ready for the harvester. Some of the late-planted fields, especially in the northern districts, would be much benefited by two to three weeks of favorable weather.

All reports show marked improvement in pasturage and meadows, and in some localities a second crop of hay will be cut. The soil is in fine condition for plowing, and more than the usual area will be turned.

BULLETIN NO. 23, SEPTEMBER 10TH.

In respect to temperature and moisture the past week was about all that could be desired for ripening crops and for general farm work. The greater portion of the corn crop is now practically safe, and harvesting is in progress in all districts. Some late planted fields would be materially improved in quality by a week or ten days of warm weather. Reports show that even in sections where the drouth was most severe the present condition of corn is much better than was anticipated a month ago. More than the usual amount is being cut and shocked.

Plowing is in progress, and a beginning has been made in seeding fall grain.

Potatoes are very promising, and pastures are generally in good condition

BULLETIN NO. 24, SEPTEMBER 17TH.

For the state at large the daily mean temperature of the past week was over 9° above the normal. On the 11th and 12th the wind velocity was high, with maximum temperatures above 90°. Light, scattered rains on the 13th, and heavy showers on the 15th, gave an abundance of moisture to the larger portion of the central and southern districts.

Rapid progress has been made in corn cutting, and except in very limited areas the crop is now well matured and safe from damage by untimely frost. Better qualities of corn may be cribbed, however, if the late planted fields can be exempt from killing frost until the close of the month.

Fair progress has been made in fall plowing, and in the larger part of the state the soil is in good condition.

Fall pasture is generally good, and some districts report an unusually fine stand of grass. Potatoes are well matured, and the crop promises a fair harvest.



## VARIABLE AND PERMANENT ELEMENTS OF CLIMATE.

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EXTRACTS FROM RECENT FARMERS' INSTITUTE TALK, BY J. R. SAGE.

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Being somewhat optimistic in temperament, I believe the near future will bring better times, greater crops, higher prices, and abundant rainfall. We are all in a suitable frame of mind to welcome most heartily an improvement on all these lines.

The recent drouth has covered a period of three years, beginning in 1893 and reaching its culmination in the crop season of 1894. The rainfall in Iowa in 1893 was  $7\frac{1}{2}$  inches below the normal amount. In 1894 it was 13 inches below normal, and in 1895 the shortage amounted to  $8\frac{1}{2}$  inches, making a total deficiency of 29 inches for the three year period. So we have had since January 1, 1893, only about two-thirds of our general average of rainfall.

And yet, marvelous as it may seem, the total soil products of this state during these three dry years have been very close to the average of any preceding period of the same number of consecutive years. In fact, our total soil output for these dry years has exceeded the products of any other state in the union for the same period. Our state has been tried "so as by fire," and it has most grandly borne the test.

The people of Iowa have been more badly scared than hurt in this recent dry period. One of the worst effects of the drouth has been in cutting short the usual supply of water for live stock and the family. It has caused much inconvenience and considerable loss; but it might have been vastly worse, and the people of this state have fared better than their neighbors on all sides. Many valuable lessons have been learned to offset the losses; but all of us would be glad to feel assured that the worst is past and that normal conditions will prevail.

My faith in the gradual return of normal seasons, with ample supply of moisture, is strengthened by a careful study of the records of past years, and the philosophy of weather changes. I can not discover the operation of any cause or causes that should have the effect to produce any radical change in the climate of this region, or of any portion of the continent. By study, observation and comparison we find certain constants of temperature, humidity and precipitation, that may be regarded as permanent features of the climate, well nigh as fixed as the everlasting hills and mountains.

And though this may seem a paradoxical statement, one of the most permanent things relating to daily and seasonal weather is the law of change, or variability in some of its principal elements. There is absolute unity with perpetual variety. No two days, or weeks, or months, or years, are entirely alike in all respects, and yet there is stability in general averages. Throughout the physical universe we note the operation of this

law of variety in unity, or changefulness, encompassed by eternal order or stability.

The weather records of every locality, and of wide areas of country, will show marked variations in the seasonal rainfall, and a perpetual succession of wet and dry periods of varying duration. There are drouths prevailing at all times within our broad domain, sometimes covering narrow areas, and at other times affecting broad belts of the continent. The general averages, or the *means* of long periods of time, may be steadily maintained, but in single years, or short periods, there are wide departures both above and below the normal line.

We have among us a class of theorists who gravely talk about a radical change of climate as a result of man's agency in the settlement and cultivation of this state. They tell us that by breaking up the prairies and draining the shallow ponds and marshes the rainfall has been materially lessened, and the showers are now more infrequent and variable than they used to be. And this work of desiccation will go on, they believe, until this once fertile state is converted into a veritable desert. This theory is based upon the assumption that there has been a steady decline in the total annual and seasonal rainfall.

In attempting the solution of this mooted question, we should remember that an ounce of fact is worth a ton of theory. And when we hear it affirmed that these notable variations in the seasonal rainfall are more characteristic of recent years than they were of the period antedating the general settlement of the country, we should call for the proofs in form of reliable figures. In these days we are making a systematic study of climate, and we have stations in every county where accurate rainfall records are kept. But in the pioneer times the number of weather observers who kept records of rainfall were few and widely scattered. In a matter of scientific investigation of such vital importance it will not be safe to trust the memories of the "oldest inhabitants," however positive they may be that the former days were vastly better and wetter than these latter-day seasons.

We have, however, a few records of seasonal and yearly rainfall that were made by a number of the pioneers of this state, and these have been preserved to serve as a basis of climatic study and comparison. By reference to these old-time records, we shall discover that variable seasons, or alternating wet and dry summers, were characteristic features of this climate thirty, forty and fifty years ago.

At Logan, Harrison county, weather records were kept by a pioneer of that section since the year 1866, covering thirty years. From those records I quote a few figures showing the variable rainfall in the summer months—June, July and August. The normal for those months at that place is about 15 inches. Following are the records:

- 1866— 7.40 inches; about half the normal.
- 1867—10.00 inches; two-thirds of the normal.
- 1869—25.80 inches; 10 inches above normal.
- 1870— 8.10 inches; a little over half the normal.
- 1871—10.90 inches; two-thirds of the normal.
- 1873—21.90 inches.
- 1874—10.30 inches.

- 1875—24.50 inches.
- 1876—11.70 inches.
- 1878—28.70 inches; nearly twice the normal.
- 1881—20.30 inches.
- 1886— 7.70 inches.

The average annual rainfall at Logan is about 35 inches. In 1880 the total for the year was 27 inches, and in 1881 it was more than twice that amount, or 56½ inches; and in one year the total fell to about 16 inches.

The oldest consecutive rainfall records kept in this state are at Muscatine, covering a period of fifty years. At that point the yearly average is about 36 inches. The average for the first decade (1846 to 1856) was 45.17 inches. From 1856 to 1866 the average fell to 25.96 inches. From 1866 to 1876 it rose to an average of 33.86 inches. From 1876 to 1886 it again rose to 40.75 inches. From 1886 to 1896 it amounted to 33.13 inches per year. The smallest amount was 25.10 inches, in 1860; largest amount, 74.80 inches, in 1851. There was less rainfall in the first two decades than in the succeeding two decades.

But the most striking variation is noted in the summer rainfall at that place. The normal summer amount is about 13 inches. The records show for June, July and August:

YEAR.	INCHES.	YEAR.	INCHES.
1846 .....	6.00	1863.....	5.31
1847.....	9.10	1869.....	23.00
1851.....	36.90	1870.....	6.44
1852.....	8.70	1871.....	16.10
1853.....	14.70	1881.....	15.51
1854.....	6.21	1885.....	17.22
1855.....	10.61	1887.....	7.40
1856.....	6.78	1891.....	13.36

These figures give the high and low water marks of summer rainfall at that station prior to 1892.

At Fort Madison the records are continuous since 1848—covering forty-eight years. In 1848 the summer rainfall amounted to 25 inches. In 1854 it was 4.46 inches. In 1855 it was up again to 16.35 inches. In 1856 it fell to 8 inches.

YEAR.	INCHES.	YEAR.	INCHES.
1865.....	18.50	1877.....	19.70
1869.....	17.50	1881.....	16.00
1870.....	9.00	1886.....	7.50
1872.....	5.00	1887.....	5.30
1873.....	6.20	1888.....	14.00
1874.....	6.00		

These figures show the ups and downs of rainfall, or the alternations of wet and dry summers in that portion of the state where our yearly rainfall is heaviest.

At Monticello the records were kept since 1854, and here are some sample figures of variation in the early years. Summer rainfall in:

YEAR.	INCHES.	YEAR.	INCHES.
1855.....	12.80	1869.....	20.75
1856.....	6.75	1874.....	6.40
1858.....	18.00	1876.....	23.15
1861.....	7.00	1886.....	4.40
1862.....	17.50	1890.....	18.50
1863.....	5.40		

Now, all these records tell the same story of variable rainfall. And the fact should be noted here that this variableness is not a special feature

of this state or of the Mississippi valley. Nearly every section of this country is subjected to occasional extremes—drouths and floods—though the plateau region between the Missouri valley and the Rockies suffers most from the frequent recurrence of drouths.

The drouth of 1894 affected more than one-third of the whole area of the United States, its greatest severity being suffered in the states west of the Mississippi. In 1895 the greatest effects of drouth during the crop season were felt in the lake region, the middle, eastern and Atlantic states.

And, as if nature set herself to work to disprove the local pond and vapor theories, some of the driest localities were contiguous to the great lakes and the ocean. At Eastport, Me., which is nearly surrounded by water, the records show a total deficiency of rainfall, for the past two years, of 52 inches. At New Haven, Conn., the shortage for 1895 was 14½ inches; and in New York city it was 9½ inches below normal. Similar records were made on the great lakes, and at points along the southern coast.

In Iowa the average or normal summer rainfall is 13 to 15 inches, the western part of the state having a slightly higher summer average than the eastern half, though the yearly average of the eastern section is the larger.

And as a rule better crops are grown in the seasons when the spring and summer rains are a little below rather than above the average. From 3 to 3½ inches a month, from May to September, coming in form of light showers, will bring ample crops if there is a moderate quantity of moisture stored in the soil at the outset.

There are more seasons when the rainfall is a little above than when it is below the requirements of our staple crops. And it may be stated that more damage has resulted in past years from excess than from deficiency of moisture.

The experiences of the last two seasons have tried men's souls and tested the qualities of their faith and philosophy. In all such times of actual or threatened disaster there are numerous prophets of evil, and many people readily accept their prognostications of calamity. And some fairly intelligent people have lost their heads and have been well nigh panic stricken when they have looked out upon their browned fields and withered crops; and their minds have been haunted by the gaunt specter of famine and starvation in the years to come.

This illustrates the need of preaching the gospel of hope and good cheer in relation to our climate; and the necessity of inculcating more hopeful and rational views as to the stability of the elements that have made this such a grand and prosperous state. Our future prosperity depends wholly upon the permanence of the fertile soil and favorable climate which have given this state the front rank in the production of the staple crops.

Our rich patrimony of fertility of soil may be wasted by faulty methods of cultivation, but, thank heaven, it is not in the power of man to change the trend of the great atmospheric currents that bear from the oceans the early and latter rains of our fruitful seasons.

The value of our farms depends in a large measure upon the stability of the climatic conditions which have given to this section its marvelous

productiveness. In fact, climate is sometimes the principal factor in the value of real estate, for in some regions they sell it at fabulous prices, with some mighty poor acres of soil thrown in to bind the bargain.

I have so large a measure of faith in the stability of natural law that if I were selling an Iowa farm I would be willing to make a warranty deed to the climate as well as the soil, and give bonds that it will maintain its average of temperature and rainfall for the coming century, and for centuries to follow.

When we have applied the principles of philosophy to the solution of meteorological problems we shall discover that the weather is controlled by laws that are fixed, definite and potential, like the forces that sway the planets and maintain the harmony of the universe. Though we observe almost infinite variability in the movement of some of the elements, and apparent aimlessness in the daily weather changes, yet by closer study we may note the operation of cause and effect as clearly as in the orderly succession of night and day.

In the science of meteorology we have to do with some permanent elements, or physical constants, which are to be regarded as prime factors in the solution of the more intricate problems. I will here note the following as most essential:

1. The solar heat is a physical constant, the earth receiving substantially the same amount of heat force from the sun from year to year. Laplace, the great French astronomer, stated that the mean temperature of the mass of the earth cannot have changed in any appreciable measure within the entire period embraced in astronomical calculations. This implies constancy in the varied operations of nature dependent upon solar heat. The air is heated by convection and radiation from the earth's surface, and this causes expansion and air movement within the lower part of the atmosphere. And because of the inequalities of the earth's surface, and marked difference in the radiating power of the various portions of that surface, there is great variability in the action of the elements.

2. Evaporation and precipitation are also constants; that is to say, they are practically invariable and substantially equal. The water that is lifted by the power of solar heat from the surface of the oceans, in the form of vapor, must in due time return to the sea to restore nature's equilibrium. The body of the atmosphere surrounding the earth is taking up vapor at all times and constantly parting with it under the cooling process in form of rain, snow, hail, mist and dew. By this unceasing process the continents are watered, made productive and habitable. Just where and when this vapor will condense and fall to the earth depends upon conditions that are beyond our ken, and certainly beyond our control. Local topography, temperature and prevailing atmospheric currents determine the time and place of precipitation.

3. The energy that produces storm movements of all kinds is also a physical constant. This is a corollary of the first proposition, that the heat of the sun is constant; for storms are the result of heat energy acting through the expansive force of air and aqueous vapor. And it is a demonstrable fact that storms are raging at all times over some portions of the earth's surface. They are nature's renovators and purifiers; and even the most violent storms—hail, lightning and wind—are products of

the benign elements whereby the earth is made a fit dwelling place for animate creatures.

If we would understand the philosophy of local weather conditions, or the cause of local drouths or floods, we must take note of what is going on in other regions. The ebbs and flows of the great atmospheric currents are continental in their scope and effects. And the amount of rainfall of this midland region is sometimes determined by influences upon the air currents thousands of miles distant, and possibly on the other side of the globe.

So while drouths or floods may be purely local in their extreme effects, yet the causes that produce them are vast in extent. We must, therefore, take broader views and widen the range of our observation if we would solve these problems; that is to say, we must embrace all the factors in our solution.

#### METEOROLOGICAL DATA FOR YEAR 1895, GRUNDY CENTER.

#### YEARLY SUMMARY, 1895.

Mean temperature for the year.....	45.8
Maximum temperature.....	95°, date, July 16
Minimum temperature.....	-24°, date, February 7
Range for the year.....	1.19
Precipitation for spring months.....	7.68 inches
Precipitation for summer months.....	14.17 inches
Precipitation for fall months.....	6.80 inches
Precipitation for winter months.....	2.17 inches
Total precipitation for the year.....	30.85 inches
Prevailing wind direction .....	Northwest
Number of clear days.....	159
Number of partly cloudy days.....	84
Number of cloudy days .....	120
Number of days on which .01 inch or more of precipitation fell.....	80

GEO. F. ELLIS,  
Voluntary Observer.

IOWA AGRICULTURAL STATISTICS.

OFFICIAL COMPILATION OF THE AGRICULTURAL CENSUS OF 1895.

FARMS, CROPS, LIVE STOCK, ETC.

Chief Landers, of the Iowa census bureau, has given to the press the following summary of agricultural statistics, from the decennial census of 1895, taken by the township assessors of the state. The work was done mainly in the winter and spring months, and the acreage and yield of crops are for the crop season of 1894—the season of the great drouth. Compared with the crops of 1895 the figures look small and insignificant. One of the most surprising features of this report is the heavy corn acreage of that year. The acreage returned is 8,648,804 acres, or a little more than one-third of the improved farm lands of the state. This census report must be accepted as the basis of estimate for this bureau, until a new census of crop acreage furnishes the means of correction.

	Number.	Acres.
Farms—40 acres or less.....	22,577	606,012
40 to 80 acres .....	44,666	3,319,865
80 to 160 acres.....	77,933	10,556,515
160 to 640 acres.....	57,885	15,538,548
Over 640 acres.....	1,326	1,278,873
Total.....	204,385	31,297,713
Average size of farms.....		153
Number acres improved.....		25,870,189
Number acres unimproved.....		5,427,624
Number acres cultivated.....		16,099,951
Value of farms .....		\$1,088,063,068
Management—Number by owner...		141,979
Number by manager.....		3,419
Number by tenant, money rent.....		83,987
Number by tenant, share rent.....		25,050
Fence—Total rods.....		141,794,780
Rods wire fence.....		119,958,858
Tiling—Total rods....		10,610,237
Rods laid in 1894.....		1,087,324
Winter Wheat—Number acres grown .....		166,433
Bushels harvested.....		2,672,601
Value of product.....		\$1,205,491
Acres sown for 1895.....		209,613
Spring Wheat—Number acres grown.....		531,466
Bushels harvested.....		6,797,695
Value of product.....		\$3,284,225
Corn—Number acres grown.....		8,648,804
Bushels harvested.....		128,989,047
Value of product.....		\$55,285,657
Oats—Number acres grown.....		4,412,243
Bushels harvested.....		107,691,460
Value of product.....		\$26,420,646



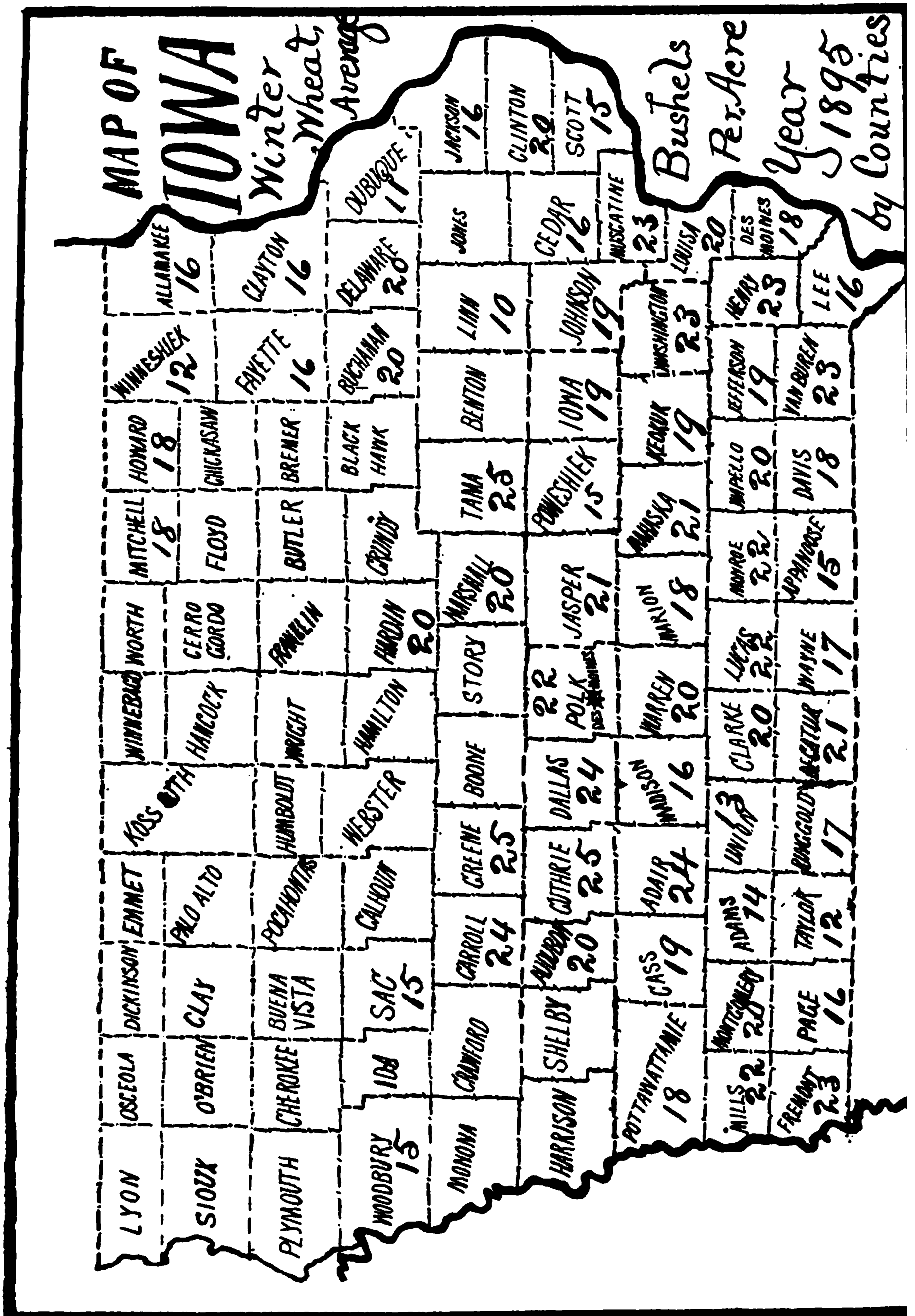
Barley—Number acres grown.....	576,475
Bushels harvested.....	8,035,634
Value of product.....	\$3,301,735
Rye—Number acres grown.....	124,154
Bushels harvested.....	1,624,078
Value of product.....	\$760,678
Acres sown for 1895.....	227,190
Buckwheat—Number acres grown.....	8,626
Bushels harvested.....	66,327
Value of product.....	\$48,082
Beans—Number acres grown.....	6,444
Bushels harvested.....	88,469
Value of product.....	\$66,591
Peas—Number acres grown.....	3,594
Bushels harvested.....	38,341
Value of product.....	\$39,120
Flax Seed—Number acres flax grown.....	201,162
Bushels harvested.....	1,371,155
Value of product.....	\$1,549,688
Timothy Seed—Number acres cut for seed.....	150,605
Bushels harvested.....	552,439
Value of product.....	\$1,119,710
Clover Seed—Number acres cut for seed.....	57,203
Bushels harvested.....	62,937
Value of product.....	\$320,133
Hungarian and Millet Seed—Number acres cut for seed.....	7,008
Bushels harvested.....	71,556
Value of product.....	\$40,219
Irish Potatoes—Number acres grown.....	170,285
Bushels harvested.....	7,869,321
Value of product.....	\$4,497,627
Sweet Potatoes—Number acres grown.....	8,406
Bushels harvested.....	195,218
Value of product.....	\$124,068
Onions—Number acres grown.....	2,139
Bushels harvested.....	174,717
Value of product.....	\$109,743
Beets—Number acres grown.....	740
Bushels harvested.....	85,118
Value of product.....	\$28,430
Turnips—Number acres grown.....	4,564
Bushels harvested.....	301,784
Value of product.....	\$72,071
Watermelons—Number acres grown.....	8,199
Hundreds harvested.....	32,920
Value of product.....	\$181,419
Timothy Hay—Number acres cut.....	2,182,791
Tons harvested.....	1,726,920
Value of product.....	\$11,741,929
Clover Hay—Number acres cut.....	196,110
Tons harvested.....	175,038
Value of product.....	\$1,022,922
Hungarian and Millet Hay—Number acres cut.....	91,167
Tons harvested.....	95,095
Value of product.....	\$499,118
Prairie Hay—Number acres cut.....	1,760,159
Tons harvested.....	1,266,688
Value of product.....	\$5,859,449
Corn stalks—Number acres cut.....	2,689,699
Value of product.....	\$9,262,534
Silcs—Number tons preserved.....	65,268
Value of product.....	\$202,724

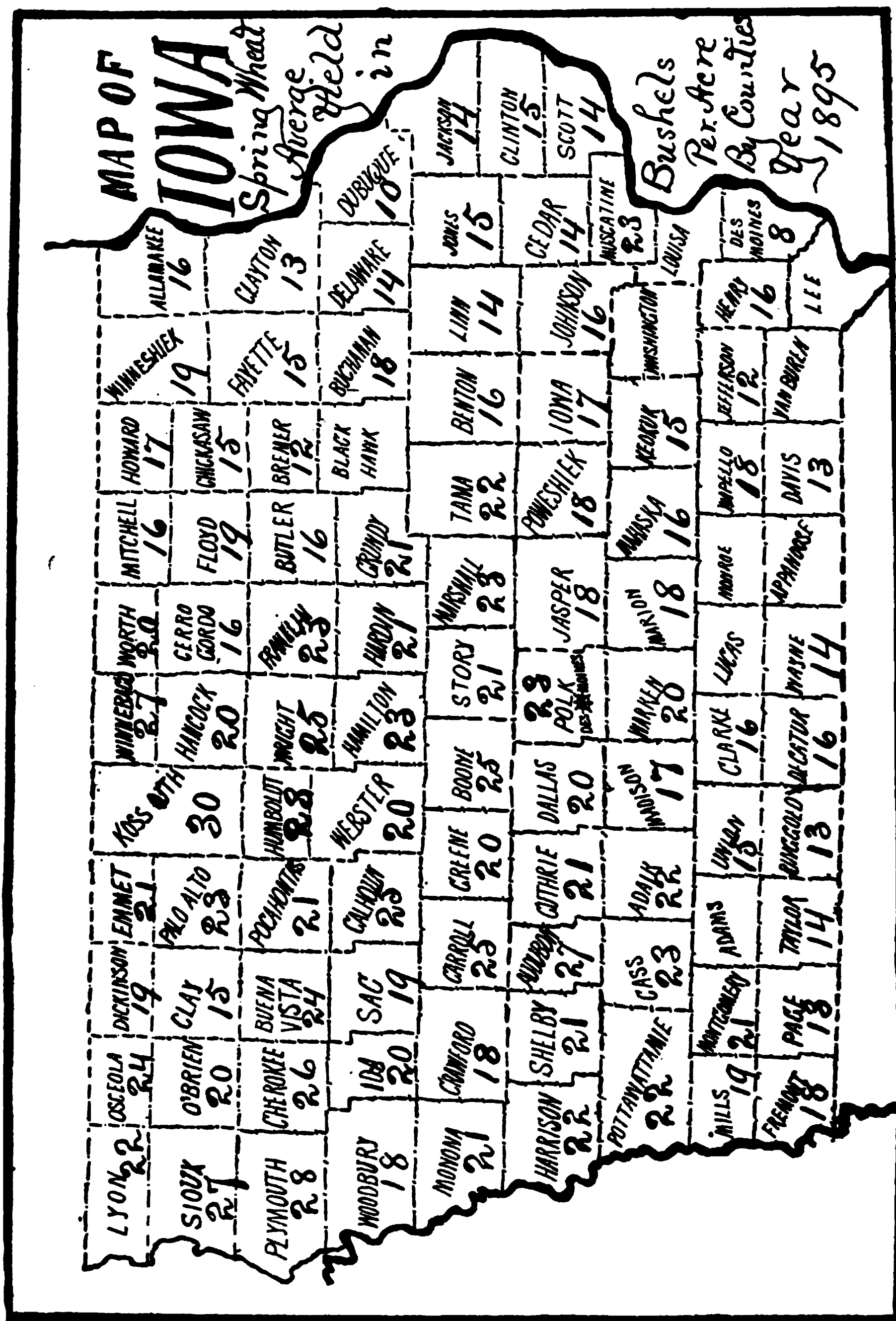


Flax straw—Number tons sold.....	6,121
Value of product.. ..	\$16,494
Pastures—Number of acres.....	8,104,230
Value of grass.....	\$14,700,792
Sorghum—Number of acres grown.....	20,073
Gallons of syrup produced.....	902,312
Value of product .....	\$380,858
Pounds of sugar produced.....	3,050
Maple Sugar and Syrup—Pounds of sugar produced.....	17,735
Gallons of syrup produced.....	3,486
Value of product.....	\$9,916
Broom Corn—Number acres grown .....	1,364
Tons harvested.....	450
Value of product.....	\$25,967
Hops—Pounds harvested....	526
Value of product.....	\$150
Tobacco—Number of acres grown.....	113
Pounds harvested.....	51,528
Value of product .....	\$4,355
Forests—Number acres planted timber .....	141,869
Number acres natural timber.....	1,505,611
Cords of wood cut in 1894.....	754,342
Value of wood consumed.....	\$1,647,105
Value of wood sold .....	\$870,787
Nurseries—Number of acres.....	3,205
Value of trees and plants sold in 1894.....	\$220,033
Apples—Number acres.....	185,545
Bushels harvested.....	2,599,884
Value of product.....	\$1,857,300
Number of bearing trees.....	2,397,798
Pears—Number bearing trees.....	16,478
Bushels harvested.. ..	4,256
Value of product.....	\$7,281
Peaches—Number bearing trees.....	97,893
Bushels harvested.....	1,726
Value of product. ....	\$3,284
Plums—Number bearing trees.....	707,506
Bushels harvested.....	164,449
Value of product.....	\$163,166
Cherries—Number bearing trees .....	274,322
Bushels harvested.....	80,650
Value of product.....	\$149,577
Number of other fruit trees not in bearing.....	20,315
Bushels of other fruit harvested.....	19,157
Value of product.....	\$14,670
Number of fruit trees not in bearing.....	1,944,408
Grapes not in Vineyards—Number of acres.....	11,408
Pounds of grapes harvested.....	4,348,721
Value of product.....	\$103,582
Gallons of wine made.....	73,912
Grapes in Vineyards—Number of vines.....	2,235,695
Pounds of grapes raised.....	7,126,895
Value of product .....	\$185,746
Gallons of wine made.....	39,370
Total number pounds of grapes raised.....	11,475,616
Value of product.....	\$290,122
Total number gallons wine made.....	113,282
Strawberries—Number of acres.....	1,392
Bushels harvested.....	20,654
Value of product.....	\$57,136
Raspberries—Number of acres .....	4,091
Bushels harvested....	22,757
Value of product.....	\$92,321

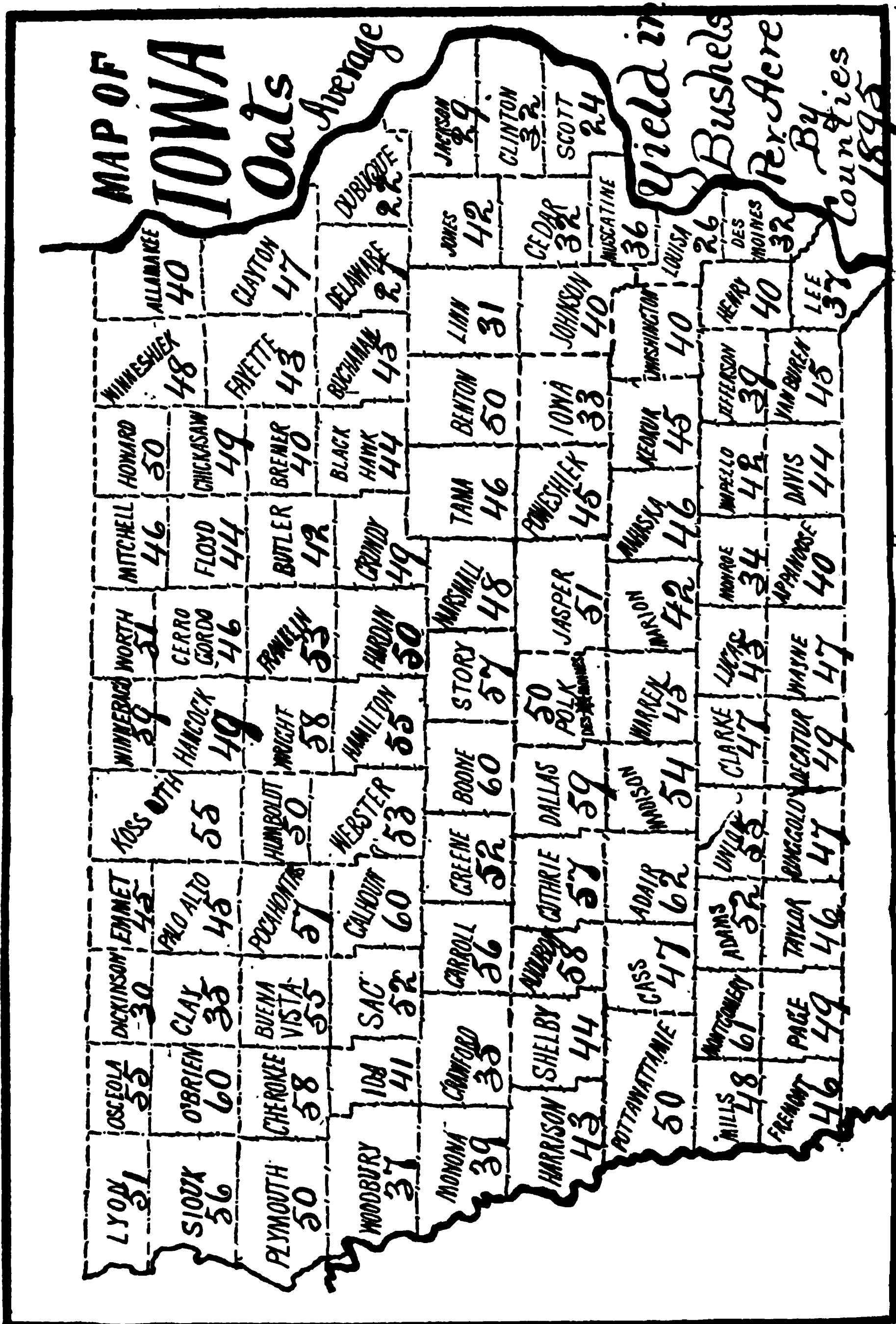
<b>Blackberries—Number of acres</b> .....	2,431
Bushels harvested.....	80,710
Value of product.....	\$80,260
<b>Other small fruit—Number of acres</b> .....	2,404
Bushels harvested.....	16,098
Value of product.....	\$26,728
<b>Horses—Number of thoroughbreds</b> .....	1,676
Number of French breeds.....	3,048
Number of Scotch breeds.....	1,087
Number of English breeds.....	1,371
Number of Standard bred.....	5,270
Number of grades.....	180,158
Number of common stock.....	1,190,692
Total number January 1, 1895.....	1,383,308
Total value January 1, 1895.....	\$41,564,546
Number sold for export, 1894.....	58,087
Value of same.....	\$2,923,918
Number imported in 1894.....	2,056
Value of same.....	\$93,819
<b>Mules—Number January 1, 1895</b> .....	35,498
Value.....	\$1,825,934
Number sold for export.....	2,044
Value.....	\$56,070
<b>Asses—Number January 1, 1895</b> .....	622
Value.....	\$95,832
<b>Cattle—Number of Shorthorns</b> .....	43,013
Number of Holsteins.....	3,305
Number of Herefords.....	3,498
Number of Polled Angus.....	4,654
Number of Red Polled.....	1,684
Number of Galloways....	1,173
Number of Jerseys.....	6,656
Number of Devons.....	374
Number of other thoroughbreds.....	6,907
Number of grades and common.....	3,126,330
Total number of cattle.....	3,197,584
Total value.....	\$53,820,197
Number of work oxen.....	460
Value of same.....	\$13,894
Number of milch cows.....	1,087,269
Value of same.....	\$23,269,763
Number sold for slaughter for domestic use.....	453,197
Value of same.....	\$10,369,954
Number sold for export, 1894.....	730,685
Value of same.....	\$23,388,510
Number imported.....	89,831
Value of same.....	\$777,058
<b>Hogs—Number of Poland Chinas</b> .....	3,319,931
Number of Berkshires.....	34,881
Number of Chester Whites.....	79,064
Number of Duroc Jerseys.....	42,019
Number of Essex.....	4,737
Number of other breeds.....	2,563,945
Total number.....	5,044,577
Total value.....	\$23,526,962
Number sold for export, 1894.....	4,234,090
Value of same.....	\$41,895,049
Number slaughtered for domestic use.....	495,445
Value of same.....	\$4,551,046
Number imported in 1894.....	21,922
Value of same.....	\$144,484
<b>Sheep and Wool—Number of Merinos</b> .....	48,730
Number of Cotswolds.....	33,582

Number of Leicestershires.....	3,099
Number of Suffolks.....	2,754
Number of Shropshire Downs.....	100,060
Number of Oxford Downs.....	8,496
Number of Southdowns.....	7,928
Number of Hampshire Downs.....	4,629
Number of other breeds.....	282,007
Total number.....	492,875
Total value.....	\$1,160,535
Number slaughtered or sold for slaughter.....	203,414
Value of same.....	\$475,889
Number killed by dogs.....	9,158
Value of same.....	\$22,564
Number of fleeces cut in 1894.....	432,412
Value of same.....	\$380,875
Dogs—Total number.....	140,446
Value of same.....	\$139,679
Chickens—Number improved breeds.....	1,688,410
Number common breeds.....	15,532,534
Total number.....	17,220,944
Total value.....	\$3,478,453
Value of chickens marketed, 1894.....	\$1,123,044
Turkeys—Total number.....	825,881
Total value.....	\$522,380
Value of turkeys marketed, 1894.....	\$713,728
Other fowls—Total number.....	382,729
Total value.....	\$162,186
Value of other fowls marketed, 1894.....	\$110,797
Eggs—Number dozens produced, 1894.....	62,710,217
Number dozens marketed, 1894.....	39,485,897
Value of eggs marketed, 1894.....	\$3,960,892
Bees—Number of stands.....	76,846
Pounds of honey produced.....	836,379
Value of same.....	\$91,513
Pounds of honey marketed.....	234,848
Other Products—Value of market garden products not included with fore- going.....	\$331,936
Value of products of the forest not including wood for fuel.....	\$141,496
Value of farm products not heretofore enumerated.....	\$298,321
Value of products of home manufacture not otherwise enumerated.....	\$63,616
Farm Mortgage Indebtedness—Number of farms mortgaged.....	83,552
Net mortgage indebtedness on farms.....	\$138,585,720



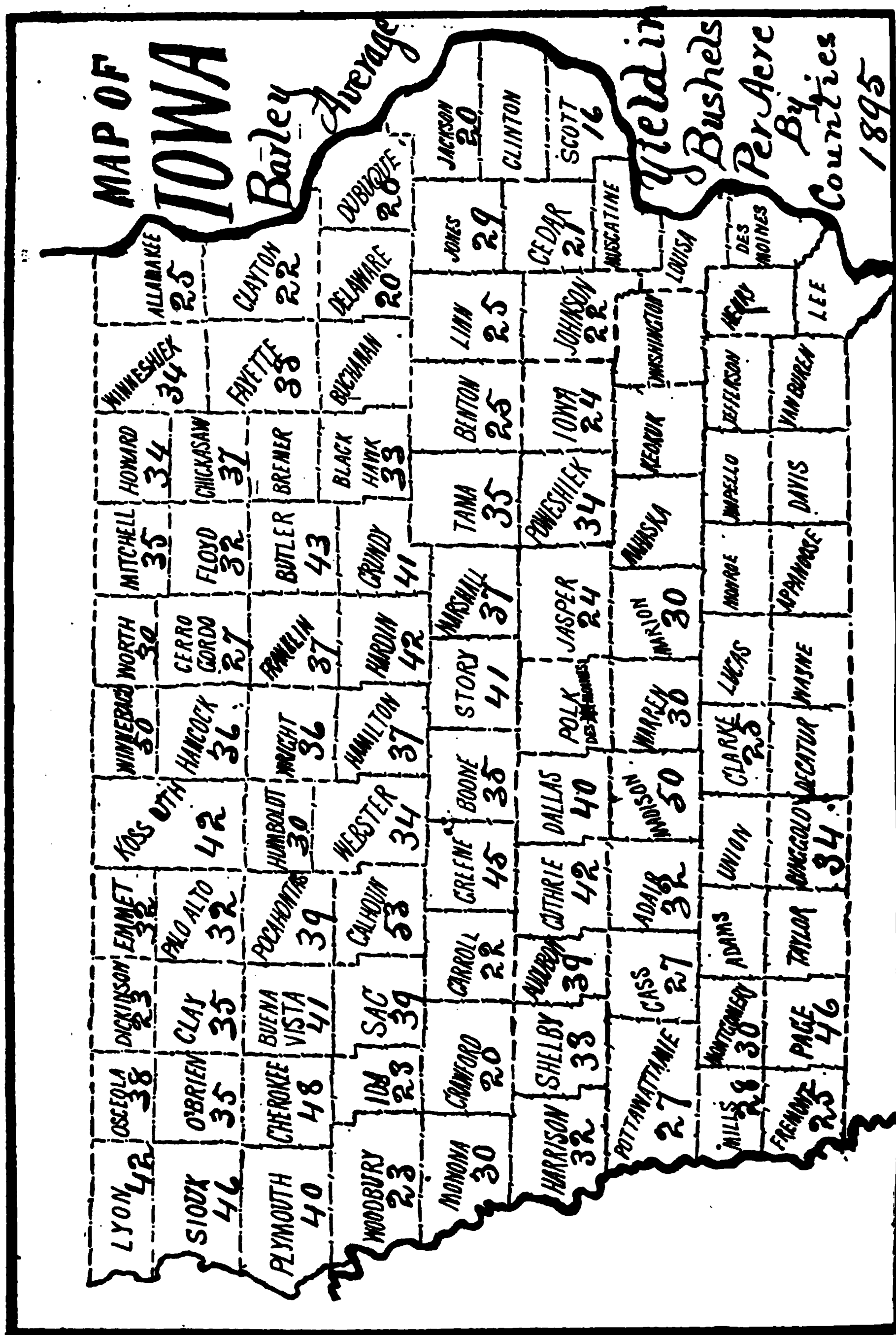




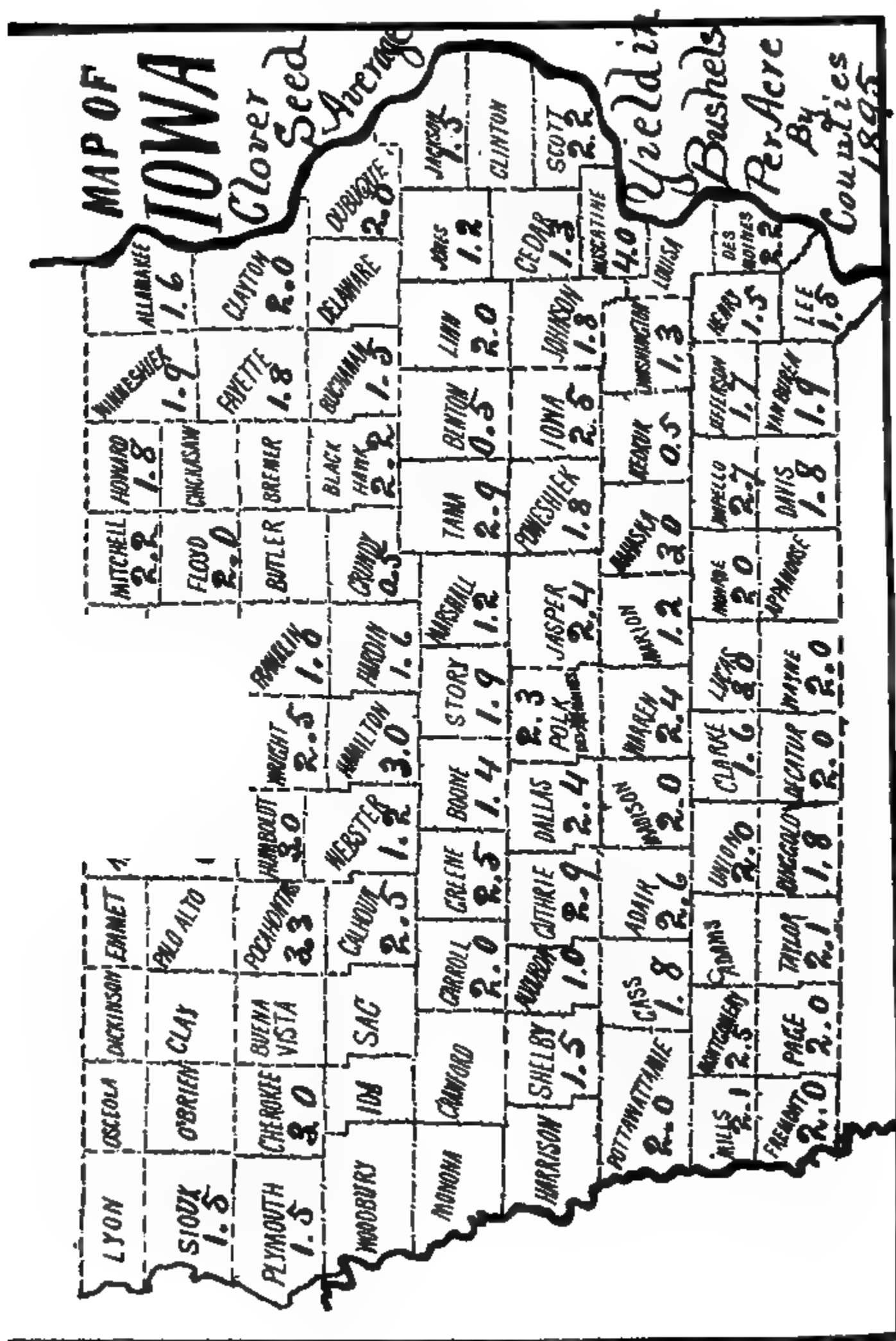


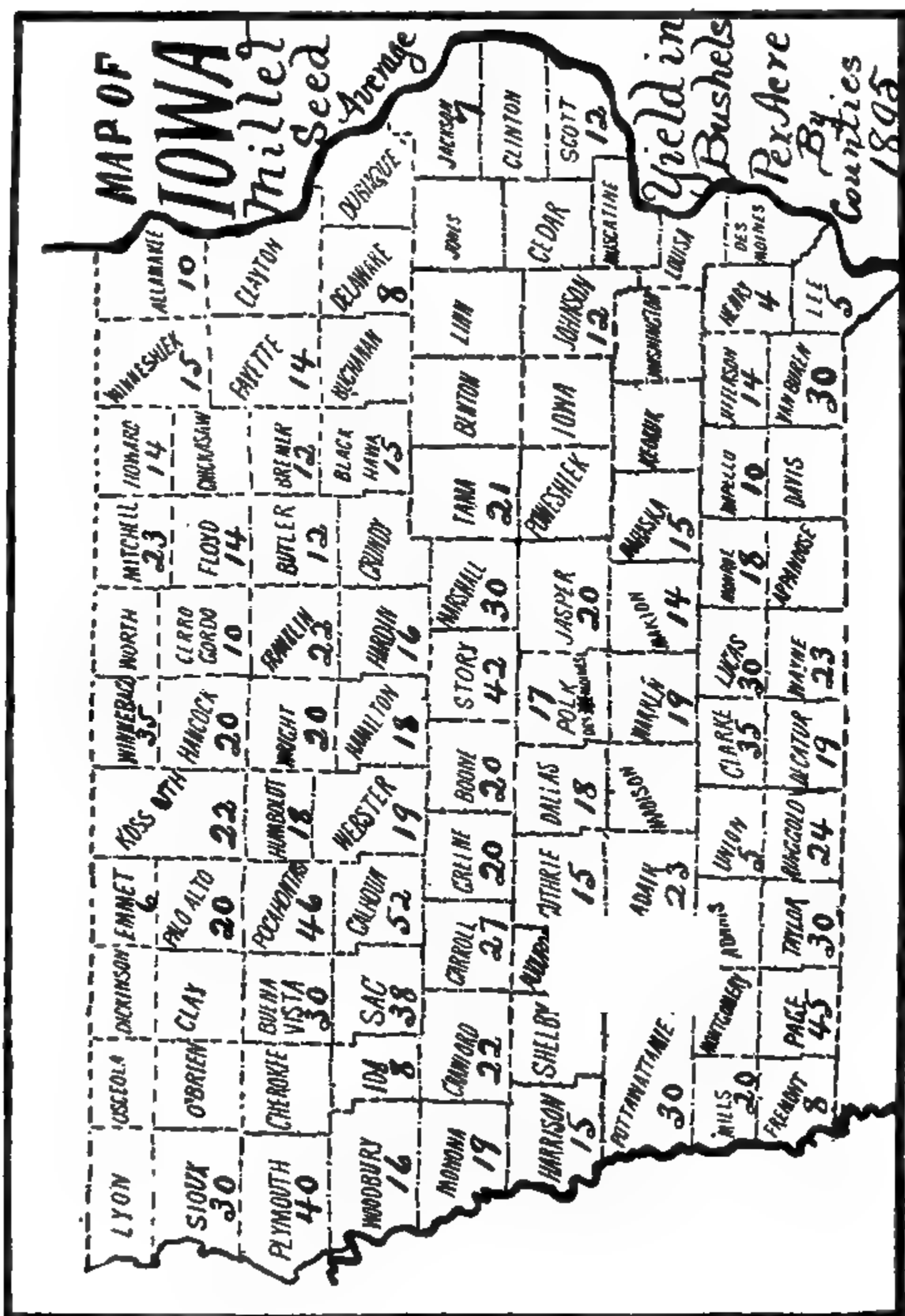


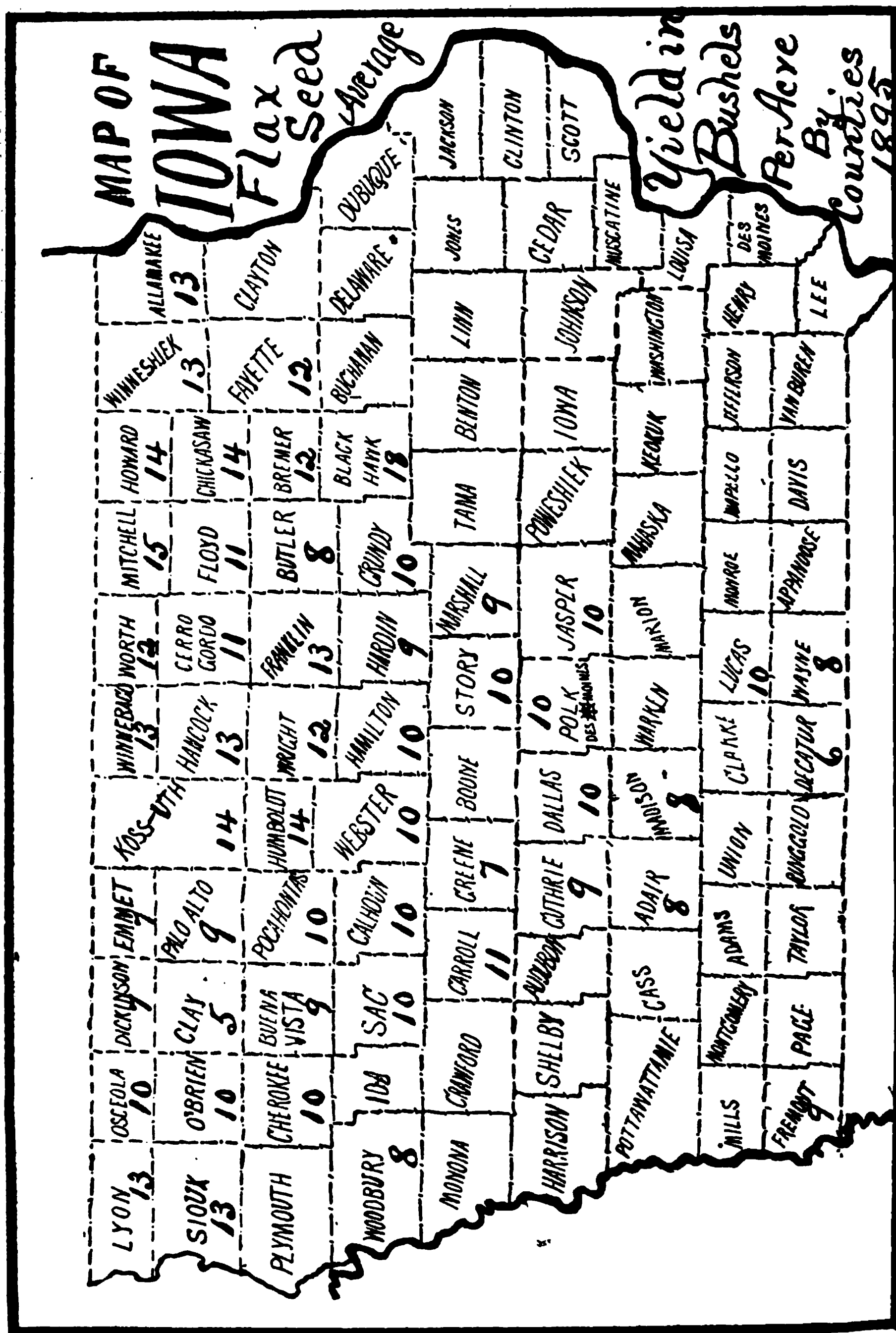


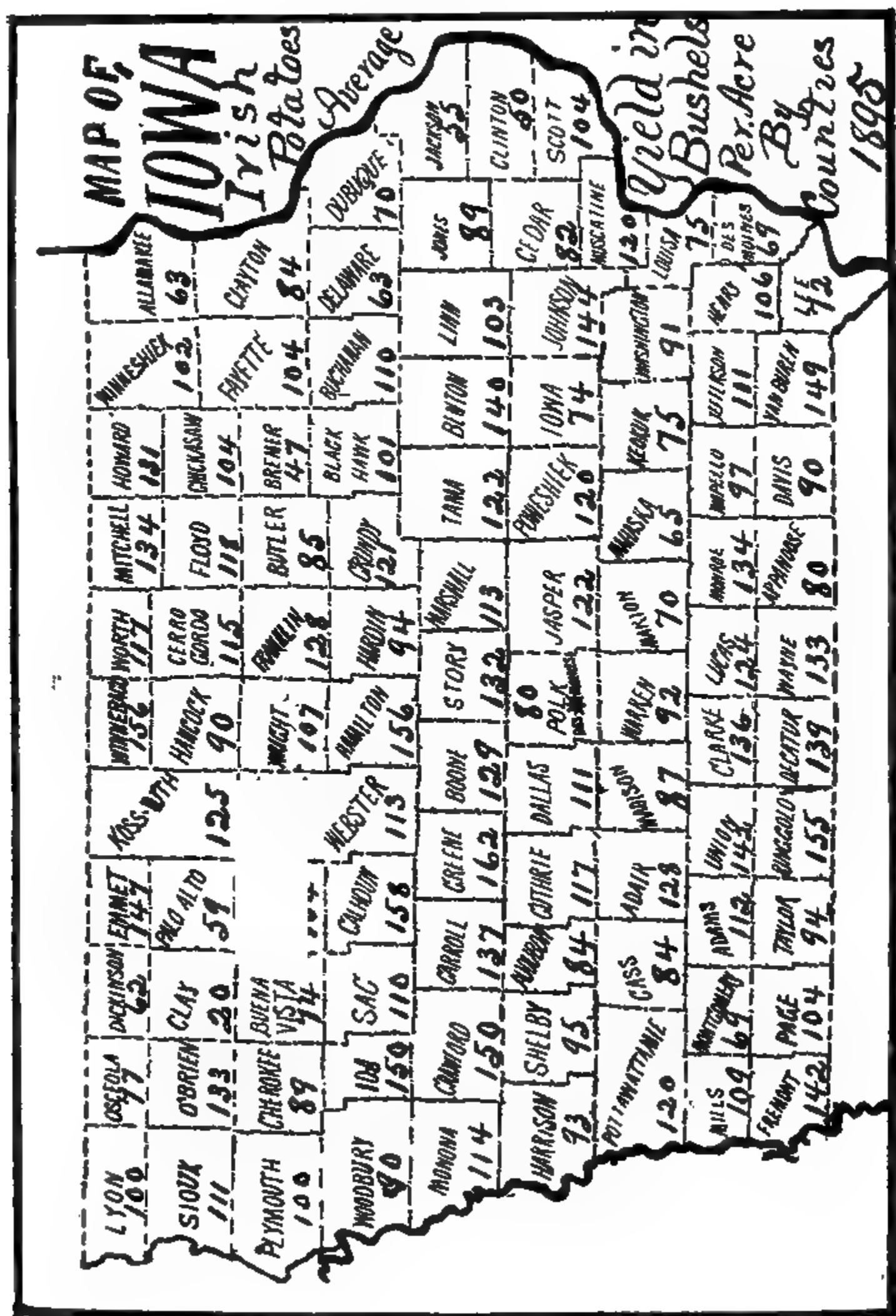


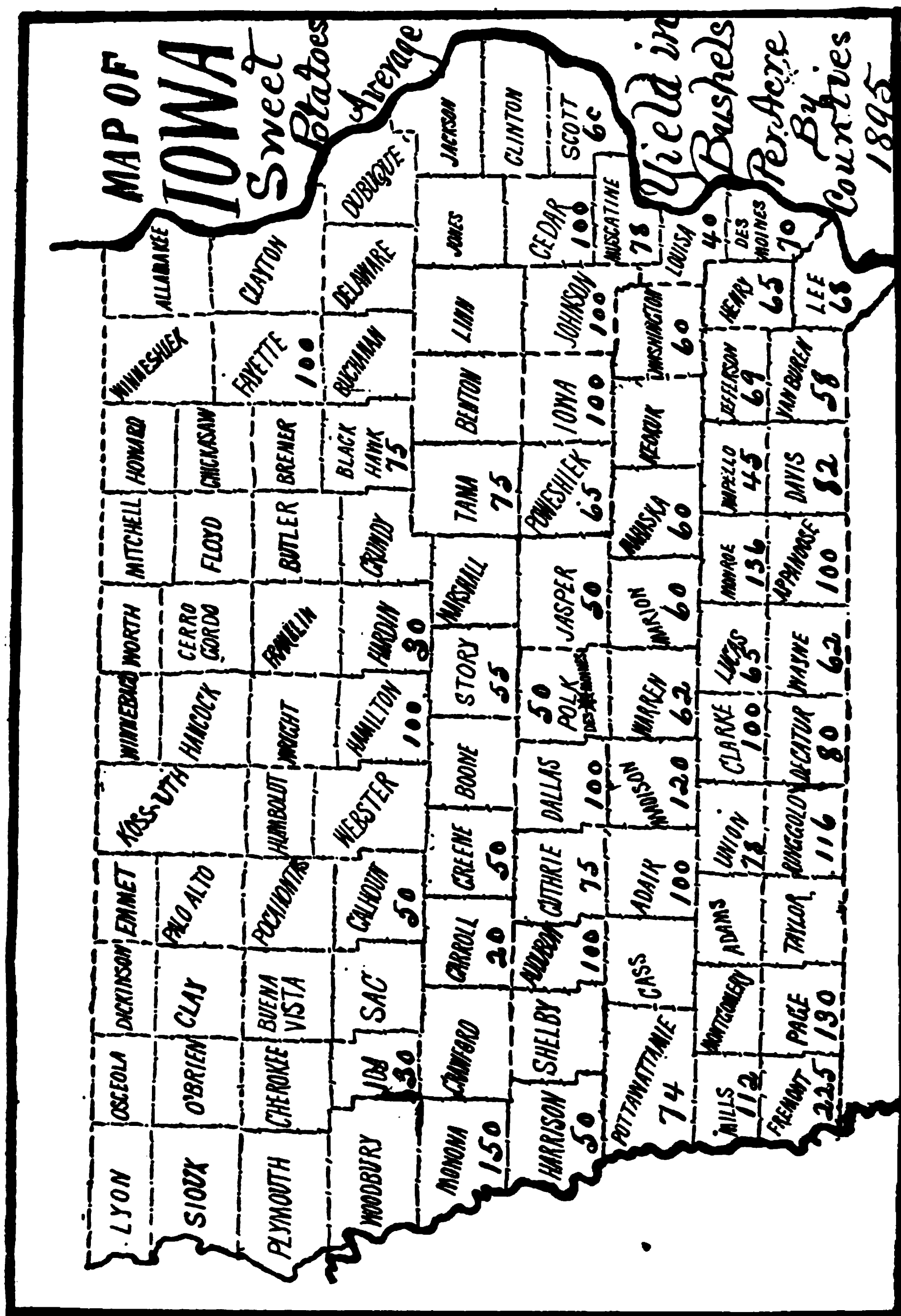


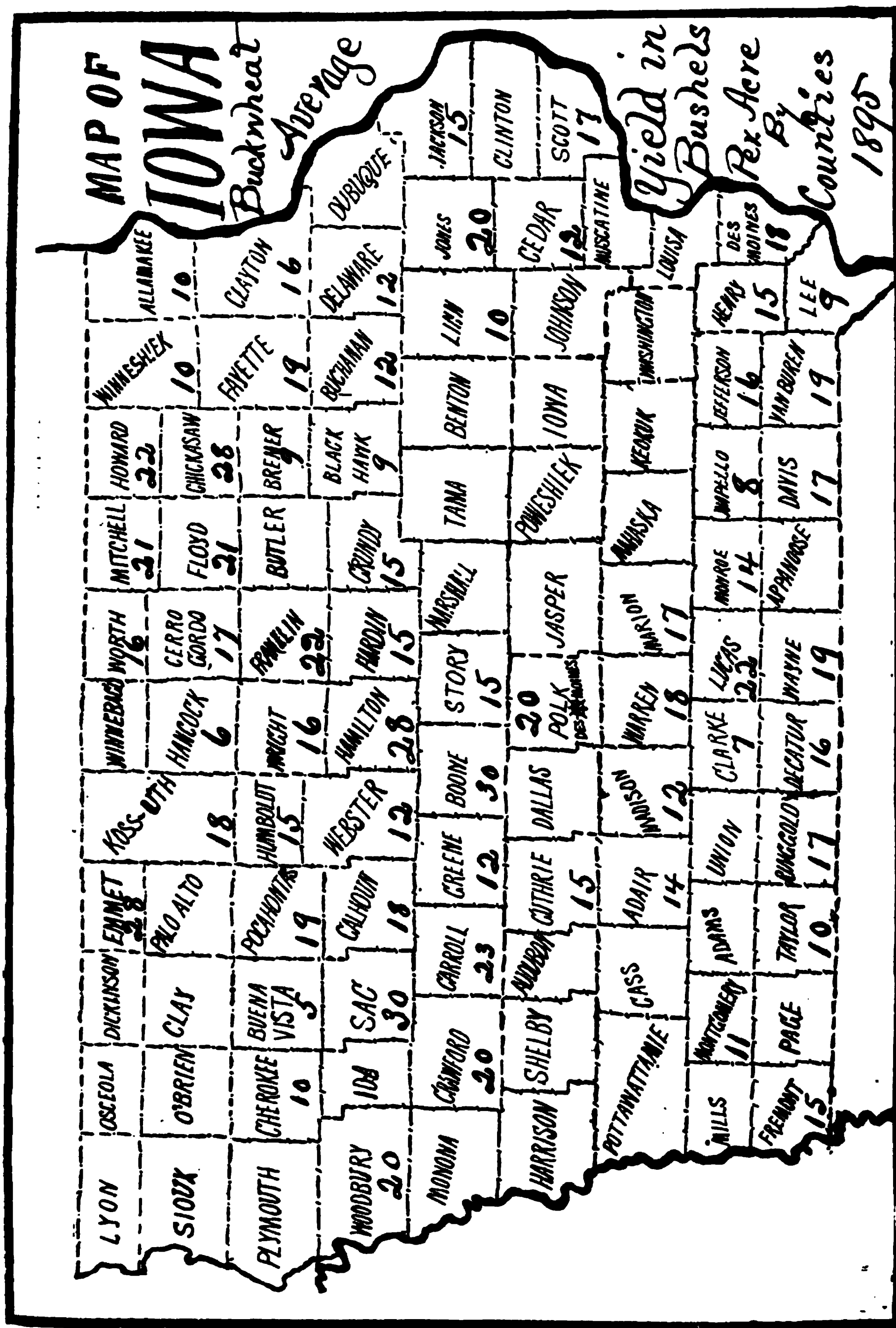




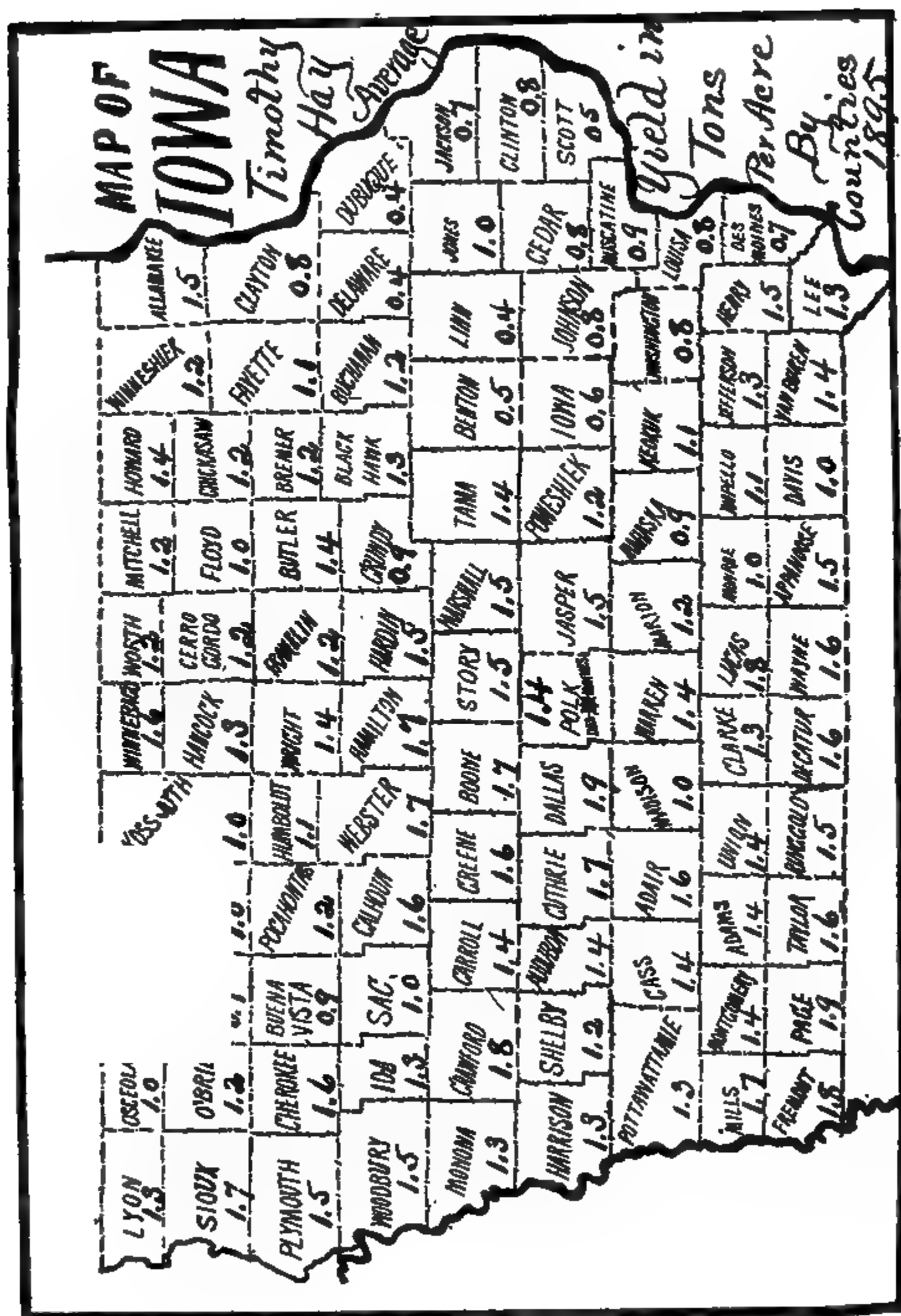


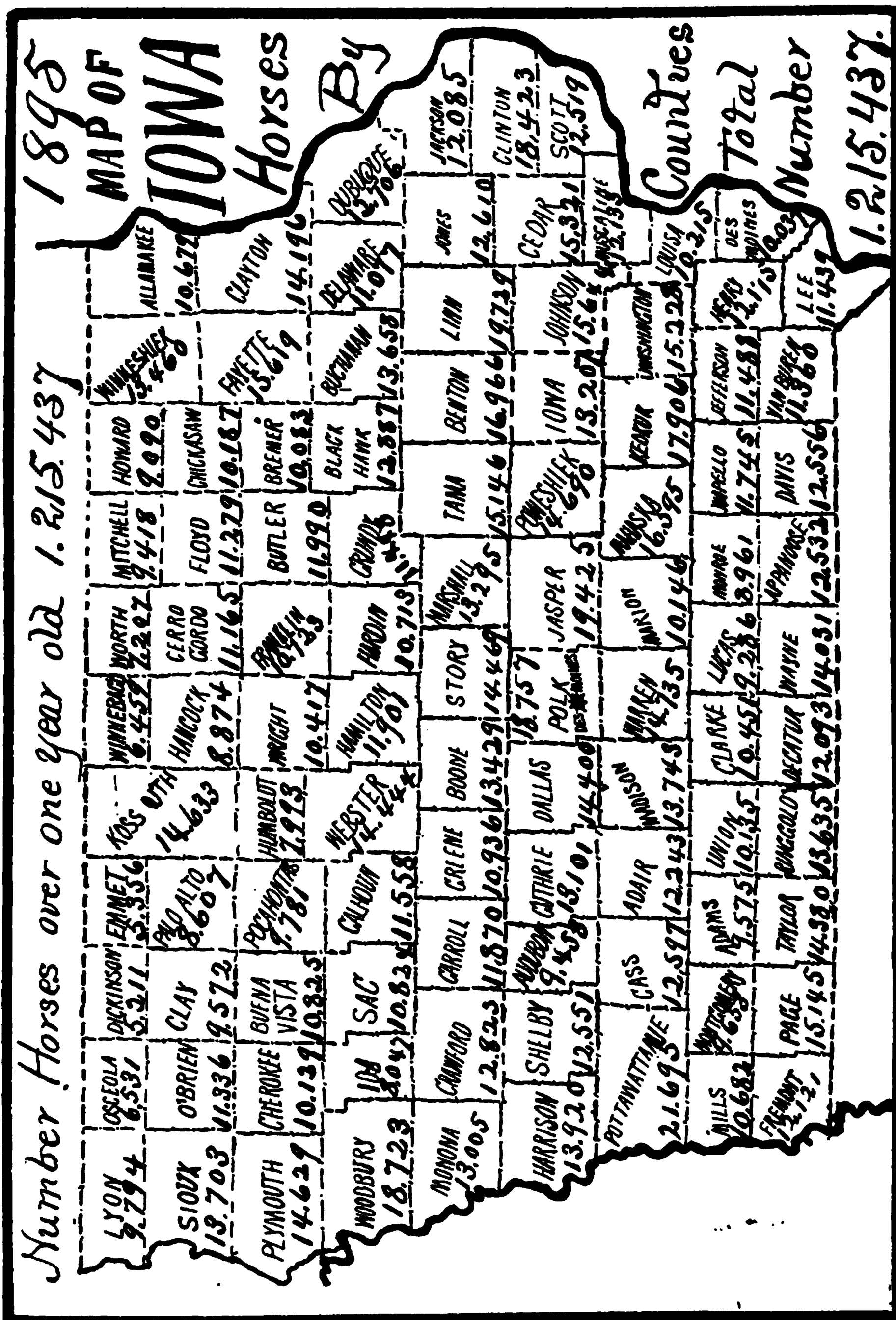


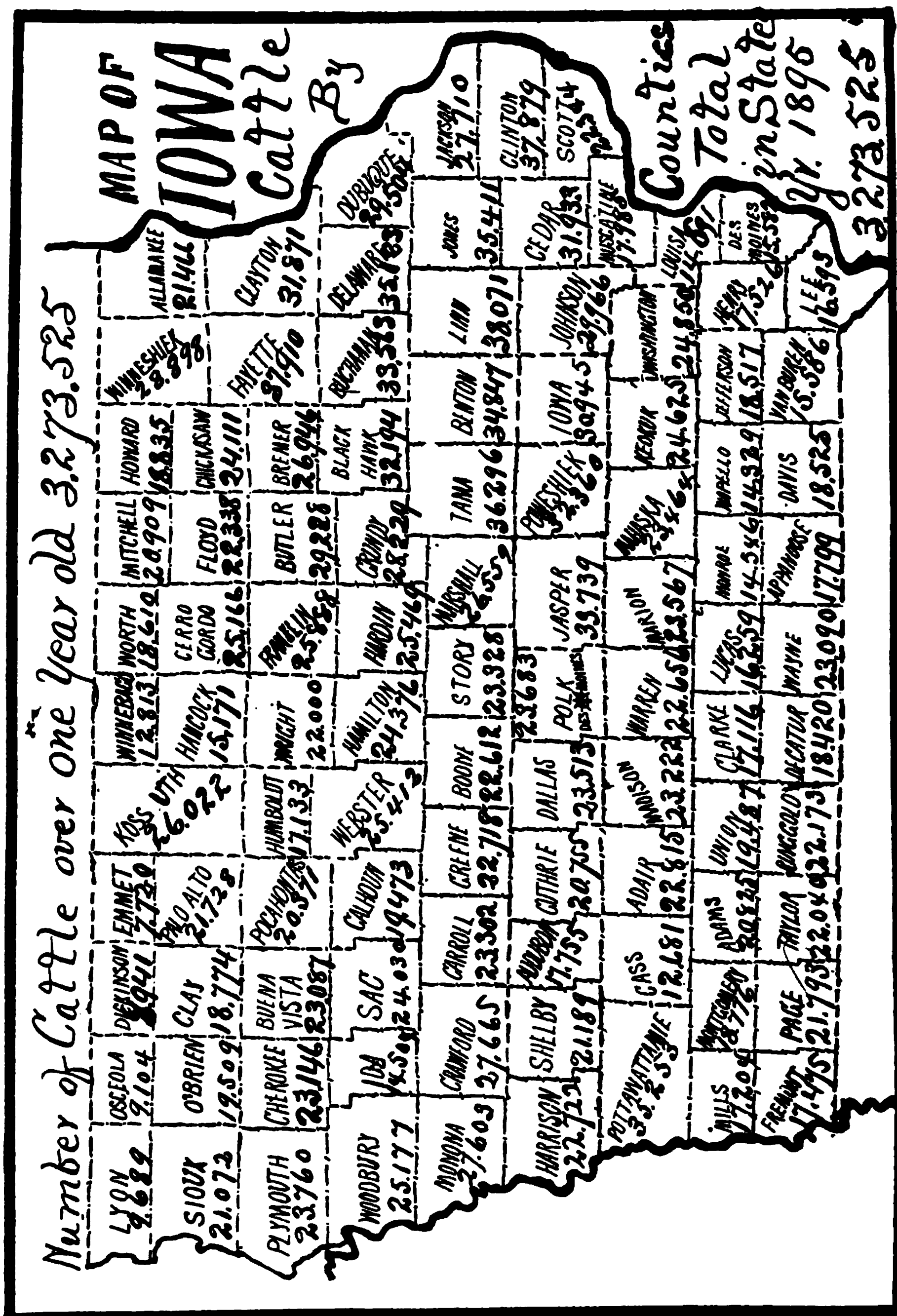
























ASSESSED VALUATION OF PROPERTY, TAXES, ETC.

Table giving acres of land, valuation of realty, personal and railroad property, as per assessment; state and county taxes; number of youth; amount of permanent school fund by counties, year 1895. (From state auditor's report.)

COUNTIES.	Acres of land.	Assessed value of land and town lots.	Assessed value of personal property.	Assessed value of railroad property.	Total assessed value for taxation.	State tax.	County, district and city taxes.	Total taxes in state due in 1895.	Number of youth.	Amount of permanent fund held by counties and state, January 1, 1895.	Amount of interest apportioned.
Adair.....	357,507	\$ 2,949,699	\$ 720,878	\$ 221,713	\$ 3,892,290	\$ 9,639.62	\$ 113,963.16	\$ 123,602.78	5,543	\$ 33,244.69	\$ 936.77
Adams.....	266,215	2,268,012	592,803	365,546	3,226,361	8,078.83	97,158.62	105,237.45	4,891	34,640.74	826.58
Allamakee.....	403,174	2,543,945	700,342	254,799	3,499,086	8,581.98	91,641.56	100,223.49	6,415	63,044.58	1,084.14
Appanoose.....	317,227	3,424,498	991,953	529,167	4,945,618	12,195.61	136,416.22	148,611.83	8,419	38,392.05	1,422.51
Audubon.....	283,449	2,704,018	558,194	118,040	3,380,252	9,280.09	96,607.53	105,887.62	4,331	40,040.37	731.94
Benton.....	442,576	5,831,034	1,549,321	643,329	8,023,684	20,019.49	149,202.31	169,221.80	8,250	30,000.00	1,394.25
Black Hawk.....	345,004	5,801,675	1,155,630	547,079	7,504,374	18,155.17	201,575.53	219,730.75	8,698	18,355.54	1,469.97
Boone.....	358,937	4,206,070	680,947	518,205	5,415,222	13,562.73	157,379.69	170,942.42	8,715	94,732.31	1,472.84
Kremers.....	269,599	2,754,135	750,825	235,513	3,740,478	9,570.86	97,515.86	107,086.72	5,170	52,599.69	873.73
Buchanan.....	352,013	4,464,988	1,249,085	305,253	6,019,375	15,366.31	143,119.99	158,426.30	6,307	9,819.16	1,065.33
Buena Vista.....	354,447	3,051,848	420,203	267,941	3,739,992	8,370.07	123,336.11	131,696.18	5,388	63,983.69	910.57
Butler.....	363,963	3,616,996	771,465	377,573	4,766,034	11,088.65	121,055.49	132,139.14	5,666	26,925.49	967.55
Calhoun.....	351,917	3,357,173	392,069	277,309	4,033,551	10,164.11	142,246.96	152,451.09	5,580	62,715.76	939.64
Carroll.....	355,219	3,601,649	590,599	555,610	4,747,848	11,433.13	149,791.06	161,224.19	6,959	19,633.15	1,176.07
Cass.....	358,142	4,624,574	1,045,312	500,062	6,169,948	15,859.89	184,822.19	200,682.01	7,401	57,962.70	1,250.77
Cedar.....	355,331	4,999,040	1,331,532	592,862	6,963,434	17,194.85	122,676.19	139,871.04	6,016	38,265.43	1,016.70
Cerro Gordo.....	338,632	3,733,076	614,451	400,399	4,747,926	11,551.91	153,895.75	165,447.66	5,979	18,035.79	1,010.45
Cherokee.....	365,309	3,454,235	649,323	363,609	4,367,167	10,568.95	143,589.57	154,158.52	5,359	67,623.91	888.77
Chickasaw.....	310,718	2,512,746	517,769	393,925	3,323,440	8,143.95	101,323.06	109,467.01	5,601	32,630.77	946.57
Clarke.....	374,897	2,388,892	573,752	376,940	3,339,584	8,575.43	91,452.85	100,028.28	4,094	45,042.19	691.88
Clay.....	350,033	3,194,400	359,222	189,000	2,742,623	6,700.96	112,411.79	119,112.75	3,782	63,810.52	639.16
Clayton.....	483,933	3,911,565	1,312,300	533,403	5,757,269	14,639.23	147,929.12	162,558.35	9,315	47,649.94	1,574.40
Clinton.....	428,991	7,145,645	1,460,715	977,714	9,584,074	24,483.14	378,439.26	402,963.40	14,031	4,410.45	2,369.55
Crawford.....	443,036	4,221,089	584,011	546,800	5,351,900	13,253.61	165,340.63	178,594.24	7,070	83,322.09	1,194.83
Dallas.....	370,724	4,797,513	1,246,407	603,531	6,647,441	15,893.23	154,763.28	170,656.56	7,218	46,533.74	1,219.84
Davis.....	316,420	2,865,517	919,374	309,353	4,094,313	9,873.41	82,509.60	92,383.01	5,390	28,632.81	910.91
Decatur.....	333,544	2,665,963	625,316	322,351	3,613,635	9,216.46	98,128.12	107,344.58	5,720	93,544.43	966.68
Delaware.....	352,937	3,321,153	863,854	420,806	5,115,815	12,700.49	123,412.26	135,112.74	6,068	12,023.07	1,035.49
Des Moines.....	256,873	6,414,167	1,790,775	478,352	8,683,294	22,159.89	335,182.22	357,342.11	12,384	23,424.77	2,032.90
Dickinson.....	235,510	1,439,104	244,429	141,737	1,875,370	4,373.63	62,799.36	67,073.61	2,067	66,513.83	349.33
Dubuque.....	373,531	9,307,393	3,190,274	566,011	13,063,583	32,166.25	563,480.39	594,646.64	19,331	5,555.00	3,255.11

Emmet.....	245,373	198,597	65,308	1,949,330	4,877.44	68,031.11	72,406.55	2,306	63,057.47	389.71
Fayette.....	453,023	995,989	444,909	5,776,486	13,898.98	135,406.31	149,306.29	8,128	69,509.47	1,373.63
Floyd.....	309,838	850,044	884,674	4,308,350	10,616.25	124,143.53	134,769.77	5,637	23,705.46	952.65
Franklin.....	361,027	531,585	261,169	4,002,479	9,634.27	123,847.84	138,502.11	4,751	26,836.85	802.93
Fremont.....	315,053	904,413	337,575	5,001,547	12,002.99	129,646.23	142,649.37	5,980	57,414.96	1,010.63
Greene.....	363,847	726,292	454,773	4,959,477	12,176.37	124,578.81	136,755.18	5,600	45,221.58	946.40
Grundy.....	812,810	534,886	188,489	3,855,705	9,834.05	97,765.59	107,599.64	4,807	22,443.45	812.33
Guthrie.....	380,086	871,214	464,815	5,212,804	13,875.08	147,806.35	161,181.43	6,355	30,155.07	1,074.00
Hamilton.....	319,490	742,443	414,839	4,827,817	11,797.11	140,298.77	152,086.88	5,951	50,691.53	1,005.72
Hancock.....	356,849	313,383	305,613	2,969,413	6,706.24	110,133.82	116,840.06	3,854	31,808.28	651.33
Hardin.....	344,935	910,564	500,915	5,189,888	12,596.20	161,357.58	173,952.78	7,276	39,069.90	1,229.48
Harrison.....	432,039	1,074,469	563,929	6,200,408	15,279.97	193,013.75	208,393.72	8,236	48,156.04	1,391.88
Henry.....	269,457	1,432,071	377,039	5,622,484	14,138.46	110,206.09	124,344.55	5,689	14,220.07	961.44
Howard.....	293,318	545,471	185,462	3,309,653	8,060.64	72,069.73	80,130.37	4,886	41,568.40	791.93
Humboldt.....	268,541	463,228	366,884	3,278,806	7,223.53	87,868.07	95,086.60	3,826	28,656.46	646.60
Ida.....	265,437	414,045	171,524	3,411,258	8,397.92	97,970.56	106,368.48	3,691	29,972.00	623.78
Iowa.....	373,716	1,004,056	417,553	5,103,888	12,819.62	124,951.56	137,771.18	6,329	81,429.50	1,069.60
Jackson.....	401,700	1,334,205	327,404	5,185,059	13,605.60	142,754.22	156,339.82	8,007	25,160.84	1,353.18
Jasper.....	452,616	1,752,269	804,950	8,384,924	19,393.56	177,099.69	196,493.25	8,582	62,549.03	1,450.36
Jefferson.....	271,517	1,011,940	602,850	5,264,363	12,534.85	118,758.68	132,293.33	5,379	27,993.33	909.05
Johnson.....	388,829	2,004,205	621,303	8,758,789	21,270.06	179,438.57	200,706.63	8,958	31,418.40	1,513.90
Jones.....	353,920	1,444,359	998,544	6,467,796	16,077.02	132,906.88	148,983.90	6,556	31,736.53	1,107.96
Keokuk.....	261,341	1,788,780	494,062	7,021,518	17,883.75	139,554.67	147,438.42	8,215	27,959.56	1,888.34
Kossuth.....	599,255	669,612	484,898	5,488,139	12,105.79	155,864.02	167,969.81	6,251	99,963.69	1,056.42
Lee.....	322,159	1,767,251	858,828	9,814,815	24,762.06	375,647.07	440,409.13	12,040	15,425.00	2,094.76
Linn.....	440,719	2,669,725	878,860	12,860,932	31,915.54	447,522.91	479,488.45	17,038	22,602.10	2,879.42
Louisa.....	250,812	947,456	359,439	3,798,632	9,460.60	85,707.57	95,168.17	4,047	21,739.57	683.94
Lucas.....	274,399	723,385	464,380	3,783,633	9,511.95	87,793.23	97,305.17	4,968	29,387.47	889.59
Lyon.....	360,529	342,981	418,563	3,648,429	8,200.32	127,103.94	135,304.26	3,896	115,671.25	658.42
Madison.....	356,261	865,563	265,574	4,489,727	10,605.58	111,478.39	122,083.97	5,805	67,031.22	981.05
Mahaska.....	356,991	1,445,289	531,250	7,332,204	18,673.21	218,529.03	237,207.24	11,038	29,396.79	1,865.42
Marion.....	355,346	1,253,908	451,655	6,193,607	16,057.20	152,702.22	168,759.42	8,303	54,029.01	1,403.21
Marshall.....	353,070	922,079	838,074	7,140,312	18,139.43	250,493.08	263,632.51	8,653	30,501.07	1,492.26
Mills.....	286,562	785,095	693,397	4,672,419	12,118.00	129,125.88	141,243.88	5,555	48,168.85	938.80
Mitchell.....	288,921	683,656	223,850	3,607,530	8,612.89	97,491.90	106,104.79	4,923	17,532.49	831.99
Monona.....	428,153	588,108	395,861	3,708,944	9,334.26	131,416.83	140,751.09	5,764	26,895.51	974.12
Monroe.....	271,408	680,498	579,342	3,580,175	9,194.86	97,846.00	107,040.85	5,269	60,912.14	890.46
Montgomery.....	261,786	1,303,023	443,913	5,534,324	13,177.72	131,920.50	144,998.22	5,570	45,772.23	941.33
Muscatine.....	265,304	1,635,785	730,285	8,024,228	19,284.45	266,834.27	286,118.72	8,070	22,006.68	1,263.83
O'Brien.....	348,806	1,635,785	395,440	4,068,059	10,324.26	140,599.64	150,923.90	4,948	112,000.00	836.21
Osceola.....	232,415	432,577	239,220	1,908,881	4,460.13	80,078.80	84,538.93	2,603	98,460.75	439.91
Page.....	335,371	218,352	239,220	6,619,545	15,969.03	169,573.87	185,542.90	7,607	77,519.44	1,385.56
Palo Alto.....	350,697	1,216,661	404,816	3,619,545	7,560.38	93,160.03	100,720.41	4,135	46,989.23	688.82
Plymouth.....	540,567	400,368	337,864	3,111,062	7,560.38	93,160.03	100,720.41	4,135	46,989.23	688.82
Pocahontas.....	354,532	734,179	503,651	6,810,235	16,318.25	195,546.93	211,865.18	7,325	121,506.24	1,237.93
Polk.....	336,054	465,579	261,916	8,679,362	7,807.29	112,719.39	120,526.68	4,282	91,355.91	723.66
Pottawattamie.....	582,813	8,115,532	1,038,600	22,625,182	56,187.60	984,968.37	1,041,155.97	22,414	49,564.08	3,787.97
Poweshiek.....	366,223	1,980,833	1,425,315	13,661,690	24,944.10	664,021.26	698,965.25	16,810	84,405.69	2,840.89
Ringgold.....	343,026	1,164,963	571,364	5,834,643	15,126.66	153,201.20	168,427.86	6,145	54,996.66	1,058.50
Sac.....	357,146	664,271	314,389	3,590,618	9,239.67	91,408.44	100,638.11	5,160	59,267.50	872.04
		536,968	273,191	4,365,960	10,692.42	127,796.15	138,486.57	5,464	18,292.43	923.42

ASSESSED VALUATION OF PROPERTY—CONTINUED

COUNTIES.	Acres of land.	Assessed value of land and town lots.	Assessed value of personal property.	Assessed value of railroad property.	Total assessed value for taxation.	State tax.	County, district and city taxes.	Total taxes in state due in 1895.	Number of youth.	Amount of permanent fund held by counties and state, January 1, 1895.	Amount of interest apportioned.
Scott.....	277,063	8,175,693	2,244,393	505,748	10,925,834	23,896.96	424,060.55	450,947.51	15,620	508.59	2,699.78
Shelby.....	875,197	3,630,766	643,095	325,064	4,603,915	11,612.16	143,400.94	155,013.10	6,287	28,319.40	1,008.50
Sioux.....	472,010	4,257,171	755,113	729,363	5,742,647	13,680.74	164,070.24	178,350.98	7,306	146,585.34	1,234.70
Story.....	352,596	3,926,092	1,003,744	651,728	5,631,564	13,890.13	154,964.41	168,874.54	6,549	49,955.97	1,106.78
Tama.....	443,272	5,372,496	1,175,295	690,801	7,238,594	18,995.06	196,567.61	214,862.67	7,729	44,567.45	1,306.20
Taylor.....	329,393	3,334,977	994,047	246,106	4,575,130	11,126.19	121,207.88	132,334.00	6,121	54,092.61	1,094.45
Union.....	263,375	2,043,329	637,540	521,622	4,202,491	10,918.11	158,524.24	169,442.45	6,301	43,618.46	1,064.87
Van Buren.....	302,116	2,286,228	1,050,621	327,680	4,664,539	12,425.94	108,521.23	118,947.16	5,757	26,948.53	972.93
Wapello.....	263,951	6,300,315	1,411,480	756,948	8,469,736	21,460.35	301,469.62	322,929.97	10,643	56,373.13	1,798.67
Warren.....	360,096	3,896,533	1,085,767	373,614	5,325,934	13,101.88	124,888.53	137,990.35	6,437	30,252.18	1,067.85
Washington.....	365,824	4,785,401	1,911,508	433,791	7,131,000	17,695.50	143,231.98	160,927.48	5,953	30,737.03	1,076.08
Wayne.....	329,619	3,083,965	959,702	411,089	4,454,696	11,559.86	99,995.29	111,555.08	5,896	72,873.30	963.63
Webster.....	438,887	4,841,431	945,583	670,731	6,457,735	15,382.30	218,232.60	233,614.90	8,524	53,626.00	1,440.55
Winnebago.....	247,208	1,692,203	233,841	141,295	2,117,339	4,617.70	75,197.40	79,815.10	3,837	97,154.86	648.45
Winnebiek.....	429,018	4,374,698	983,892	359,866	5,678,441	12,830.78	125,149.42	137,980.20	7,689	20,093.93	1,299.44
Woodbury.....	535,414	12,045,977	4,866,879	615,269	17,528,125	61,436.93	888,623.79	940,060.72	17,737	91,693.00	2,997.55
Worth.....	250,489	1,622,968	359,255	208,078	2,190,401	5,025.19	63,118.29	68,143.48	3,885	26,850.53	656.57
Wright.....	261,137	2,723,445	496,124	364,070	3,575,689	8,492.47	138,017.87	146,510.34	5,317	44,939.83	808.57
State bonds.....										10,937.18	
Total.....	34,696,686	\$ 413,970,588	\$ 100,492,479	\$ 44,531,235	\$ 558,985,902	\$1,238,226.12	\$ 17,109,257.63	\$ 18,497,483.75	697,228	\$4,707,608.70	\$ 117,831.53
Telegraph companies.....								14,909.53			
Telephone companies.....								4,890.00			
Grand total.....								\$ 18,517,283.28			



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UNITED STATES  
DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU.

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ANNUAL REPORT

OF THE

Iowa Weather and Crop Service

FOR THE YEAR 1896.

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JOHN R. SAGE,  
*Director.*

GEO. M. CHAPPEL, M. D.  
*Local Forecast Official, U. S. Weather Bureau,  
Assistant Director.*

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STATE OF IOWA,  
OFFICE OF THE WEATHER AND CROP SERVICE, }  
DES MOINES, April 15, 1897.

*To His Excellency, Francis M. Drake, Governor of Iowa:*

SIR—In accordance with the requirements of the law, we have the honor to submit herewith the seventh annual report of the Iowa Weather and Crop service for the year 1896. We are, sir, very respectfully,

Your obedient servants,

JOHN R. SAGE,

*Director.*

GEO. M. CHAPPEL, M. D.,

*Local Forecast Official, U. S. Weather Bureau,*

*Assistant Director.*



## ANNUAL REPORT, 1896.

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This service has made a steady and substantial growth during the year covered by this report; and there has been a very gratifying increase in the public interest in relation to the scientific and economic data collected and tabulated by the aid of the efficient and public spirited corps of meteorological observers and crop correspondents, whose fidelity is gratefully acknowledged and appreciated.

This is an age of statistics, and the value of reliable data of the climatic conditions and crop productions of any portion of our great country is recognized by scientists, statesmen and business men of all classes. In this leading agricultural state we are making progress, both in the scientific study of the climate and in a practical knowledge of the almost limitless resources of crop production of our fertile soil.

By the co-operation of the State Weather and Crop Service and the National Weather Bureau the results achieved are much more valuable than could be secured without such unity in the work. The efficient chief of the U. S. Weather Bureau, Prof. Willis L. Moore, has placed the officers of the state service and the people of Iowa under heavy obligations by making every effort in his power to disseminate the daily forecasts to all localities that may be reached by wire or mail. At this time the number of forecasts sent to Iowa postoffices by mail exceeds 1,000; and by telegraph 103 places are recipients of these benefits. Many of these towns served by wire are distributing stations whence postal cards are sent to the towns that may be served by earlier mails.

There is a steadily increasing demand for copies of the Monthly Review and the Weekly Weather Crop Bulletins issued by this service. During the year the number of copies of the Review amounted to over 30,000; and the issue of Bulletins was about 2,200 per week, from April to October.

The records of the local stations of this service have been called into courts quite frequently as evidence in the trial of cases wherein questions of fact arise in relation to meteorological conditions on certain dates or specified times. In many instances the testimony thus obtained from these official



figures and notes, made by trained observers by the aid of the best instruments obtainable, have been found to be of inestimable value.

There are connected with this service 123 meteorological stations, of which number 116 report temperature and rainfall, and 7 rainfall only. The observers at 77 of these stations are supplied wholly or in part by state instruments.

#### METEOROLOGICAL STATIONS AND OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Adair .....	F. L. Morrison.	Keosauqua.....	Prof. J. H. Landes.
Afton .....	Hon. N. W. Rowell.	Knoxville .....	Casey and Reaver.
Algona.....	O. D. Pettibone.	Le Claire .....	River Observer.
Alta.....	D. E. Hadden.	Lansing .....	G. H. Markley.
Alta (near).....	W. J. Minard.	Larchwood.....	E. W. Stokes.
Amana.....	Conrad Schadt.	Larrabee.....	H. B. Strever.
Ames .....	Exp. Station.	Lenox.....	J. L. Hurley.
Atlantic.....	J. W. Love.	Le Mars .....	Dr. T. E. Cole.
Atlantic.....	Geo. W. Franklin.	Linn Grove	
Audubon.....	F. P. Hocker.	(Mt. Vernon)....	Rev. J. W. Hubbard.
Belknap.....	A. W. Rankin.	Logan.....	Mrs. M. B. Stern.
Belle Plaine.....	S. P. Vandike.	Malvern.....	R. F. Norton.
Bonaparte.....	Hon. B. R. Vale.	Maquoketa.....	Dr. A. B. Bowen
Britt.....	G. P. Hardwick.	Mason City.....	H. I. Smith.
Carroll.....	Moses Simon.	Marshalltown....	O. M. Cook.
Cedar Falls.....	Prof. A. C. Page.	Maxon (Albia)....	Gus Johnson.
Cedar Rapids....	Elec. Light & Power Co.	Millman.....	W. H. Shaul.
Centerville.....	Prof. H. E. Reister.	Moorar.....	F. G. Thomas.
Chariton.....	Hon. S. H. Mallory.	Monticello.....	Henry D. Smith.
Charles City.....	J. W. Smith.	Mt. Vernon.....	Prof. A. Collin.
Clarinda.....	A. S. Van Sandt.	Mt. Ayr.....	J. W. Beard
Clinton .....	Luke Roberts.	Mt. Pleasant.....	Dr. Max E. Witte.
College Springs..	Prof. H. K. Holcomb.	Neola .....	J. H. Garland, Jr.
Corning.....	John W. Bixby.	New Hampton...	O. L. Gabrielson.
Council Bluffs...	J. B. Rishel.	Newton ..	A. Lufkin.
Cresco .....	Gregory Marshall.	Northwood.....	A. L. Thompson.
Davenport.....	*F. J. Walz.	Odebolt.....	E. Starnier.
Delaware.....	Wm. Ball.	Ogden.....	E. Sayre.
Decorah .....	F. H. Baker.	Omaha, Neb.....	*L. A. Welch.
Denison.....	Wm. A. McHenry.	Osceola .....	A. W. Lewis.
Des Moines.....	*Geo. M. Chappel, M. D.	Ovid .....	H. O. Miller.
Dows.....	R. E. Fuller.	Osage.....	G. D. Pattingill.
Dubuque .....	*L. M. Tarr.	Oskaloosa.....	Jos. Boyd.
Eldora .....	Prof. O. F. Woodward.	Ottumwa.....	L. J. Baker.
Elkader.....	Chas. Reinecke.	Plover.....	J. S. Smith.
Estherville. ....	M. L. Archer.	Portsmouth.....	J. W. Dahlheimer.
Fairfield .....	Charles J. Fulton.	Pringhar .....	E. S. Proper.
Fayette .....	R. Z. Latimer.	Red Oak.....	Geo. W. Holt.
Ft. Madison.....	Miss L. A. McCreedy.	Reinbeck .....	Dr. L. B. Hathaway.
Fonda.....	Chas. F. Linnan.	Rock Rapids.....	W. O. Wyckoff.
Forest City.....	J. A. Peters.	Rockwell City...	Prof. G. B. Rigg.
Fredericksburg...	O. E. Wright.	St. Charles .....	R. D. Minard.
Galva.....	W. A. Crowley.	Scranton.....	N. O. Nelson.
Garden Grove....	M. Wemple.	Seymour.....	Mrs. O. A. Conger.
Gladbrook.....	Geo. F. Parker.	Sibley .....	H. G. Doolittle.
Glenwood.....	J. P. Jackson.	Sidney .....	G. V. Swearingen.
Grand Meadow,		Sigourney .....	Prof. E. H. Griffin.
(Postville) .....	F. L. Williams.	Sioux City.....	*U. G. Pursell.
Greene .....	J. L. Cole.	Sac City ..	Dr. O. Brown.
Greenfield.....	J. G. Culver.	Spencer.....	S. Gillespie.
Grinnell.....	Prof. S. J. Buck.	Spirit Lake.....	W. O. Drummond.
Grundy Center...	Geo. F. Ellis.	Stuart .....	J. C. Pugh.
Guthrie Center..	W. T. Anderson.	Toledo.....	Chas. Mason.
Hampton.....	E. O. Grenelle.	Vinton .....	T. F. McCune.
Hawkeye.....	Miss I. Whorley.	Villisca .....	H. O. Stoddard.
Hopeville.....	M. T. Ashley.	Washington.....	Wm. A. Cook.
Humboldt.....	H. S. Wells.	Waterloo.....	M. L. Newton.
Independence....	E. F. Wulfke.	Waverly.....	H. S. Hoover.
Indianola .....	Prof. J. L. Tilton.	Waukee.....	N. O. Wragg.
Iowa City.....	Prof. A. A. Veblen.	Webster City....	Louis Frank.
Iowa City.....	Mrs. O. M. Hobby.	Wilton Junction.	J. M. Rider.
Iowa Falls.....	J. B. Parmelee.	Winterset .....	W. W. McKnight.
Keokuk.....	*Fred. Z. Gosewisch.	West Bend .....	Phil. Dorweiler.

\* U. S. Weather Bureau.

## WEATHER CROP OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Agency.....	J. H. Van Zant.	Le Mars.....	Hon. Henry Schrooten.
Albia.....	Wm. Mercer.	Lawler.....	Hon. Wm Glattly.
Alta.....	Jonas Cushman.	Lockridge.....	John F. Farman.
Ames.....	O. D. Reed.	Marshalltown...	Hon. S. B. Packard.
Atwood.....	J. H. Tanner.	Mason City.....	Wm. Nettleton.
Battle Creek....	A. Preston.	Mapleton.....	A. Lamb.
Boone.....	L. O. Morris.	Mt. Pleasant....	W
Bristow.....	G. W. Wells.	Milton.....	H d.
Centerville.....	Henry Galley.	Mount Vernon..	M
Charles City....	W. B. Towner.	North English..	J.
Chariton.....	C. O. Burr.	Nevada.....	G
Clarksville....	F. M. Russell.	Osage.....	E
Correctionville..	Hon. W. B. Chapman.	Orange City....	H
Corning.....	Jerome Smith.	Paton.....	A
Clermont.....	Chas. Larrabee.	Pittsburg.....	G
Council Bluffs..	L. Prouty.	Rock Rapids....	D
Oreston.....	M. V. Ashby.	Rockwell City..	J.
Danville.....	Sherman Matthews.	Rossville.....	T
Emerson.....	D. B. Nims.	Ruthven.....	F
Ely.....	Hon. A. J. Fuhrmeister.	Sageville.....	H
Fulton.....	Carl S. Frank.	Seymour.....	L
Fontanelle.....	Hon. L. M. Kilburn.	Shenandoah....	Reuben Mullison.
Ford.....	J. O. Richards.	South Amana...	John Cowrie.
Fort Dodge.....	R. W. Blaine.	State Center....	E. P. Thompson.
Geneva.....	Wm. H. Thompson.	Sumner.....	John Dawson.
Grinnell.....	A. O. Price.	Tama.....	W. G. Malin.
Guthrie Center..	W. W. Bailey.	Unity.....	Edw. Hummer.
Hesper.....	G. E. Dillingham.	Van Horne.....	Spencer Smith.
Hodge.....	James Piper.	Washta.....	H. L. Felter.
Humeston.....	Hon. S. H. Moore.	Willow Creek...	W. S. Nicholson.
Independence....	C. L. Thomas.	Winterset.....	H. A. Kinsman.
Indianola.....	T. B. Hammer.	Wall Lake.....	T. E. Wilcox.
Jefferson.....	S. M. Taylor.	Wilton.....	Thos. Boot.
Knoxville.....	G. W. Mendenhall.	West Union....	J. W. Bopp.
Larrabee.....	H. H. Carnahan.		

## METEOROLOGICAL SUMMARY FOR 1896.

*Atmospheric Pressure.*—Mean atmospheric pressure for the year, 30.03 inches. The highest pressure recorded at any station was 30.90 inches, on January 3d, at Clarinda and Omaha; and at Cresco November 30th. The lowest observed was 29.13 inches, on March 28th, at Sioux City. The range for the state was 1.76 inches.

*Temperature.*—The mean temperature for the year was 48.5°, which is about 2° above the annual average. The highest mean reported was 53°, at Keokuk, and the lowest 41.2°, at Sioux City. The maximum temperature reported was 104°, at Malvern, Estherville and Madrid, on July 3d, and the same extreme at same places August 7th. The minimum for the year was 20° below zero, on January 4th, at Cresco. The range for the state was 124°.

*Precipitation.*—Average for the year, 37.45 inches, 2.57 inches above the state normal. The highest total recorded was 51.60 inches, at Waterloo. Davenport and Primghar reported the lowest amount—28.68 inches.

*Wind and Weather.*—Prevailing direction of wind, northwest; highest velocity, 60 miles an hour, at Davenport, May 16th. Average daily wind movement, 191 miles. There were 145 clear, 105 cloudy and 161 partly cloudy days. Rain fell at some point in the state on 86 days.

## RELATIVE HUMIDITY.

For the purpose of study and comparison we give below some figures showing the mean relative humidity of the air at the central station at

Des Moines for the six crop months (April 1st to October 1st) in the years 1894 and 1896. The season of 1894 was phenomenally dry, especially during the crop growing months of May, June, July and August. The season of 1896 was unusually wet, with more than normal amount of cloudiness. The following table gives the mean monthly humidity for the two seasons, expressed in percentages:

MONTHS.	1894.	1896.
April.....	63.7	63.6
May.....	54.6	69.1
June.....	54.6	66.9
July.....	45.8	69.5
August.....	55.8	72.6
September.....	69.1	76.8
Means.....	57.2	69.5

Here we note a difference of 12 per cent in the mean relative humidity of these two seasons. For the four crop months, May to August, the mean in 1894 was 52.7 per cent, and in 1896 it was 69.5 per cent, a difference of about 17 per cent. During the month of July, 1894, the humidity measured only 45 per cent, and there were many days when the evening observations showed from 15 to 30 per cent of relative humidity. In July, 1896, the average was about 70 per cent, and there were some days when the maximum reached very near to the point of saturation.

In 1894 the air was so dry that the dew point was very near the line of freezing temperature, while in 1896 the percentage of humidity was so high that rainfall resulted from a slight fall of the temperature.

The year 1896 is notable from the fact that the fall months were excessively damp, cloudy and cool. It was a year without an Indian summer, which is a rare occurrence in this region.

MONTHLY SUMMARIES FOR 1896.

JANUARY.

The month was usually mild and pleasant. The mean temperature for the state was 23.4°, which is 7° above the January normal. The coldest period was from the 1st to the 5th, and the lowest recorded temperature in the state was 20° below zero, at Cresco, on the 4th.

The average precipitation was .48 of an inch—.9 of an inch below normal. The least amount reported was a trace, at Denison and Rock Rapids; the greatest amount 2.10 inches, at Seymour.

There were 10 clear days, 11 cloudy, and 10 partly cloudy. The highest atmospheric pressure of the year, 30.90 inches, occurred on the 3d, at Clarinda and Omaha.

FEBRUARY.

The month was unusually warm and pleasant, and notably free from violent storms and the extremes incident to midwinter in this midland region.

The monthly mean temperature for the state, as reported by ninety-two observers, was  $27.4^{\circ}$ , which is about  $5^{\circ}$  above the February normal. The highest reported was  $78^{\circ}$ , at Glenwood and Omaha, on the 26th; lowest,  $13^{\circ}$  below zero, at Cresco, on the 20th, and Wilton, on the 17th. During the past twenty-five years there have been six warmer Februarys.

The average precipitation was .71 of an inch. Ottumwa reported the largest amount, 2.40 inches; least amount, .04 of an inch, at Spencer. There were 12 clear days, and more than the average amount of sunshine.

#### OBSERVERS' NOTES.

*Bonaparte*—HON. B. R. VALE: The winter's frost practically out of the ground. A mild, pleasant and profitable month.

*Charlton*—HON. S. H. MALLOY: Roads have been good all the month except the last week.

*Clarinda*—A. S. VAN SANDT: A warm, dry month. A good deal of ground plowed during the last week.

*Clinton*—DR. LUKE ROBERTS: Thirteen days of fair sleighing during the month. The windstorm of the 18th amounted to a blizzard, as the snow lying on the ground was lifted and drifted about most fantastically, and it was accompanied by a liberal supply of sand and dirt which the 30-mile wind had gathered.

*Elkader*—CHARLES REINECKE: Ice broke and went out in Turkey river on the 25th.

*Emmetsburg*—J. H. CARMICHAEL: Dust and sandstorm on the 18th; geese and ducks flying north on the 14th; meadow larks seen on the 28th.

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#### MARCH.

The month of March was cool and dry. The mean temperature for the state was  $30.9^{\circ}$ , which is about  $1^{\circ}$  below the normal. The highest temperature reported was  $81^{\circ}$ , at Belknap, on the 30th; lowest,  $12^{\circ}$  below zero, at Rock Rapids, on the 13th.

The average precipitation, as shown by reports from ninety-nine stations, was 1.10 inches, which is .97 of an inch below normal. Sidney reports the largest amount, 3.99 inches, least amount, .16 of an inch, at Keosauqua.

The worst storms of the month were duststorms, which were quite severe in many localities. There were 12 clear days, 10 cloudy and 9 partly cloudy.

#### OBSERVERS' NOTES.

*Belle Plaine*—S. P. VANDIKE: Duststorm on 21st, continuing all day, restricting the range of vision to a few rods.

*Bonaparte*—HON. B. R. VALE: A dry, windy month. Farm work began on 23d. Soil very dry. Only about one-fourth the usual rainfall for the month.

*Charles City*—J. W. SMITH: A great amount of dust in the air, on windy days, from the 18th to the 26th. On the 21st the sun was almost obscured by the dust. On the 30th was another dark day, followed by rain and thunderstorm.

*Corning*—J. W. BIXBY: Heavy thunderstorm on evening of the 27th, the first of the year. Thermometer fell  $40^{\circ}$  in six hours on the 31st.

*Dows*—R. E. FULLER: Very high wind, with clouds of dust, on the 21st. First thunderstorm of the year on the 27th, with hail; another of the same sort on the 31st.

*Clinton*—DR LUKE ROBERTS: March, 1896, did not depart materially from the characteristics of the first spring month. Most of the conditions were near normal.

The mean temperature of the month was  $32.4^{\circ}$ ; the highest temperature,  $69^{\circ}$ , date 31st; lowest temperature,  $5^{\circ}$  above zero, date 13th; coldest day,  $13.7^{\circ}$ , date 12th; rainfall, 95 of an inch; number of storm days, 7; number of cloudy days, 9; number of clear days, 11; per cent of cloudiness, 46; prevailing direction of wind, northwest; maximum velocity, 22 miles an hour, date 21st; total movement of wind, 5,500 miles. The greatest March movement of wind during the last fifteen years was 8,330 miles, occurring in 1882.

#### APRIL.

The noteworthy features of the month of April were abnormally high temperature and excessive rainfall—a combination rarely experienced so early in the season. The mean temperature for the state was  $54.5^{\circ}$ , which is  $6.5^{\circ}$  above the normal. The first decade was unseasonably cold, the records of the central station showing an accumulated deficiency of  $51^{\circ}$  (below normal) on the 9th; but at the close of the month there was an excess of  $166^{\circ}$ , an average daily excess of  $5.5^{\circ}$  for the full month. The last freeze was noted on the morning of the 10th, after which date there were no killing frosts observed in the state. It was the warmest April, on the average, ever known in this state since the stations of observation have been established; and it was also one of the wettest Aprils on record.

The average precipitation for the state was 5.02 inches, which amount is 2.42 inches above the April normal in Iowa. The distribution was more nearly equal than usual, all parts of the state receiving ample moisture to serve the present needs of vegetation. The highest amount reported was 9.67 inches at Cedar Falls, and the lowest, 2.35 inches at Keokuk. Distributed by districts the averages were about as follows: Northeast district, 6.02; North Central, 6.01; Northwest, 5.78; West Central, 6.30; Central, 5.20; East Central, 5.70; Southeast, 4.10; South Central, 3.40, and Southwest, 3.45 inches. A considerable portion of the precipitation that fell in the first decade was in the form of snow, sleet and hail.

The high temperature and frequent showers of the second and third decades of the month pushed vegetation forward at an unusual pace, and at the close the season was rated as ten days earlier than the average of recent years. It was a notably favorable month for farm work and growth of crops.

#### OBSERVERS' NOTES.

*Alta*—DAVID E. HADDEN: On April 7th, from 5 to 7 o'clock P. M., a very heavy thunderstorm, accompanied by high wind, hail, sleet and snow, and followed by heavy rain, prevailed. Hail and sleet drifted from six to eight inches deep in places. Lightning was intensely vivid and sharp, and struck several telephone poles near town; the storm was a phenomenal one for the time of year. Another heavy rain, with sleet, occurred on the 8th, from 3 to 7 o'clock P. M.

*Clinton*—DR. LUKE ROBERTS: My memory does not recall an April during the last two decades in which so many meteorological conditions seemed more happily combined and seasonable, than those credited to April, 1896.

The mean temperature was  $56.5^{\circ}$ , or  $7.4^{\circ}$  above normal. Not only this, but it was the warmest April in eighteen years by  $3.2^{\circ}$ . April, 1881, was the cold April, recording a mean of  $42.7^{\circ}$ , giving a range of temperature of  $13.8^{\circ}$ .

The cold period of the month was from the 1st to the 10th; the last freeze occurring on the latter date. After this, on the 22d, there was one light frost.

Total precipitation for the month was 4.33 inches. This is 1.33 inches above normal. There was thunder and lightning on seven different days, but mostly mild—no damage reported.

*Bonaparte*—HON. B. R. VALE: A seasonable month, very like that of 1895, only warmer. Rainfall for March and April this year exceeds same period last year by .08 of an inch—nothing to brag on.

*Corning*—J. W. BIXBY: There were eight thunderstorms during April, but none of much severity. Fine growing weather.

*Grand Meadow, Clayton County*—F. L. WILLIAMS: Rainfall, 6.32 inches—the heaviest for any April in fifty years. In 1856 the amount was 5 inches. Springs and wells beginning to run.

*Grundy Center*—GEO. F. ELLIS: Good feed in pastures April 10th.

*Humboldt*—H. S. WELLS: This season beats last year in every way. Fruit in full bloom. Work well along.

*Iowa Falls*—J. B. PARMELEE: Sixth, sowing wheat; 13th, seeding begins in earnest; 16th, making garden; 20th, plowing for corn begun; 27th, plum blossoms; 28th, apple blossoms.

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## MAY.

The month was characterized by the prevalence of low atmospheric pressure, high temperature, excessive rainfall and severe local wind-storms.

The mean temperature for the state, as deduced from ninety-nine stations, was  $65.5^{\circ}$ , which is  $5.8^{\circ}$  above normal. It was the warmest May since 1881, according to the records of the United States Weather Bureau stations within the state.

The average rainfall for the state, as shown from records of 107 stations, was 6.69 inches—2.54 inches above normal. The highest measurement was reported from Mt. Ayr—11.79 inches. All parts of the state suffered to some extent from excess of moisture. The bulk of the rainfall came in the second decade of the month.

## OBSERVERS' NOTES.

*Amana*—C. SCHADT: During the thunderstorm on the 23d, 1.70 inches of rain fell in twenty minutes, and 1.94 inches in fifty-five minutes.

*Bonaparte*—HON. B. R. VALE: Exceedingly wet since the 12th; 7.54 inches of rain, the greatest monthly precipitation for five years. No farm work done since the 12th.

*Toledo*—CHARLES MASON: The total precipitation for the two months,

April and May, is 11 08 inches, and for the year up to the present time is 12.62 inches. The general outlook for crops is splendid

*Onawa*—C. G. PERKINS: Following are the records of precipitation at Onawa from January 1st to June 1st, 1896: January, .30; February, .28; March, 1 34; April, 6.18; May, 7.34. Total for the five months, 15.44 inches. The average for this period in the last seventeen years is 11 34 inches.

#### MAY'S DESTRUCTIVE STORMS.

[From Monthly Review, May, 1896]

The meteorological pendulum, in swinging from the extreme of drouth to the opposite extreme of excessive rainfall, brought the usual accompaniment of elemental disturbance. The reaction, as was to be expected, caused numerous violent local storms, involving sad losses of life and property.

This great interior valley is irrigated by cyclonic storms which must needs be produced by a vast expenditure of nature's energies. These cyclones are as essential as sunshine to the life, health and prosperity of this region, and though the gigantic forces employed in the production of cyclonic movements sometimes cause violent action of the elements, yet the good resulting therefrom immeasurably exceeds the incidental ill.

The month of May, 1896, has been made historic by its unusual number of violent local storms, involving considerable loss of life and destruction of property amounting to millions of dollars. These more violent disturbances have occurred within a wide belt extending from near the Gulf of Mexico to Lake Huron, involving portions of Texas, Oklahoma, Kansas, Nebraska, Missouri, Iowa, Illinois and Michigan, with considerable excess of force in a number of states eastward of this belt. Iowa has suffered quite severely, though the life and property losses have been much less than in a number of other states

#### THE STORM OF MAY 24TH.

The most disastrous windstorm of the month in this state occurred on the night of Sunday, May 24, and the worst effects were produced in Polk, Jasper, Delaware and Clayton counties.

That day was one long to be remembered by those who took note of the meteorological conditions. The remark was frequently heard, "This is a genuine cyclone breeder." The wind was southerly, the temperature of the day being considerably above normal, with a high percentage of humidity and increasing cloudiness.

The weather map on the morning of the 24th showed a "low," or cyclone, advancing from the northwest. The evening map indicated that the low had advanced rapidly during the day, and was then central in South Dakota, Iowa being in the southeast quadrant of the depressed area.

At the Des Moines station the air seemed unusually oppressive, with high "sensible temperature," and with the approach of nightfall the western heavens became murky with advancing storm clouds. At about 9 P. M. a very heavy and threatening bank of cloud appeared in the northwest, coming rapidly toward the southeast, apparently moving directly toward this city. The flashes of lightning were vivid and almost incessant, and, as the cloud approached, the sound of thunder was continuous,



varied only by frequent louder crashes and crackling of the electric fluid. Scuds of clouds and some heavy masses of cumulus were observed moving with unusual rapidity from the south and southwest toward the vortex of the coming storm. In fact, the visible masses of vapor from all points appeared to be drawn irresistibly to the center of the storm, as puffs of smoke are drawn toward the funnel of a chimney.

An apparent change was then noted in the direction of the storm, its course being deflected toward the east and northeast. The central shaft of disturbance passed within six miles of the northern limit of Des Moines, and its swiftness of movement was noted when it reached a point directly north of the city. The characteristic roar of the tornado was heard by hundreds of observers who closely watched the awful spectacle. The sound was easily distinguished from the frequent peals and crashes of thunder, being continuous and resembling the noise of heavy trains on a distant railway. Those who noted the passing of that storm and heard its peculiar roar were strongly impressed by the belief that the next morning would bring news of disastrous effects along its pathway from west to east; and the result more than justified their fears.

The character of the storm was made evident by observations at points where the greatest destruction was wrought. The people who resided in or near its pathway say that heavy rain and sharp lightning preceded the windstorm, which lasted but a few moments.

The records of the insurance offices of this city, wherein losses by wind are covered, show that the storm began its work of destruction southwest of Woodward. The first complete loss occurred in section 31, Des Moines township, Dallas county, where the barns and residence of a Mr. Gill were swept away, happily without loss of life. At this point a schoolhouse was whirled away, leaving the floor, and not a timber of the house has been discovered. In section 34 of the same township, the buildings of Mr. William Nixon were damaged. The storm passed north of Granger, causing damage at various points. In section 4, Jefferson township, Polk county, Mr. Heckman's buildings were destroyed and a fine grove of trees ruined—"twisted into matches"—but no one injured. At that place, Mr. Heckman says, the storm cloud deflected southward a mile or two, then crossed the river and went eastward toward Ankeny, Bondurant and Valeria. A number of losses were suffered near Ankeny, in Crocker township; also in Douglas and Franklin townships, near Bondurant. The storm then passed into Poweshiek township, Jasper county, striking Valeria in its course, and going thence north of east to a point near Baxter, where its destructive force abated. From the point of inception to its ending the track forms a slightly curved line, or change of course from southeast toward the northeast. The width of the main track was from about 1,000 to 3,000 feet. Outside of this track some destructive effects were produced by lateral currents, or side winds flowing towards the central shaft or funnel. There are some indications of the action of several minor tornadoes within the belt covered by the storm. Losses have been reported in Madison township, several miles from the main track.

A visit to Bondurant and Valeria, by the director and assistant director of this service, gave sufficient evidence as to the character of the storm. The characteristic effects of tornadic force were noted at a number of points, notably at the Bailey farm, near Bondurant, at Valeria and in the



timbered tract along the Great Western railway east of the latter place. On the south side of the central track trees and wreckage of buildings pointed toward the northeast; north of the center the debris was strewn towards the southwest. The uplifting power of the storm were shown in the uprooting of trees and tossing them bodily, roots, trunks and branches, over the railway embankment. The writer saw one instance of that kind, the tree measuring 18 inches in diameter at the butt and well proportioned in height. Scores of very heavy trees were first uprooted and then dragged bodily, tops foremost, from five to ten rods. The destruction of the railway bridge beyond Valeria was a marvelous exhibition of the uplifting force of the storm at the center of its track.

Luckily there was no town on the direct line of the storm, though it narrowly missed Bondurant and grazed Valeria closely. If either place had been right in its path, no habitation or other building would have survived the shock. The entire length of the pathway of destruction was nearly forty miles, though at numerous points on the line but slight effects are visible.

The destruction of property will probably aggregate from \$70,000 to \$80,000; but worst of all is the loss of human lives, and the terrible suffering endured by the bruised and mangled survivors. The total number of deaths is reported to be twenty people, of various ages.

The time occupied in passing over the forty miles of its track was about an hour and twenty minutes, as nearly as we can estimate from the various reports. It is said that the clocks which were stopped near Valeria, point to the hour of 10:40. At Bondurant the residents say the storm struck there at 10:30. It certainly began its operation at the extreme western end of the line as early as 9:20 P. M.

#### STORMS AT OTHER POINTS.

On the same night (May 24th) severe wind squalls occurred at various points in Delaware and Dubuque counties, followed by heavy downpours, causing destructive floods.

Near Manchester numerous buildings were leveled by the hurricane, and at Dyersville and New Vienna extensive damage was caused by floods.

A cloudburst caused a very damaging flood between North McGregor and Beulah, and newspaper reports state that three whole families were swept away with a loss of eighteen lives. The entire valley between those two points was swept nearly clean of bridges and buildings. Numerous freight cars were swept from the tracks of the Chicago, Milwaukee & St. Paul road and several thousand feet of railway track carried away.

The floods were also damaging at Dubuque, and at Durango, six miles west of Dubuque, the railway station was swept away and five persons were drowned. It was a night of fearful storms, attended by loss of life and property, in Iowa, Illinois and other western states.

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#### JUNE.

The month of June was notably genial and favorable to all forms of life. The mean temperature for the state was 69 1°, which is the normal for the month. There were but few oppressively warm days, and these were followed by nights of refreshing coolness.

The average precipitation, as shown by the records of 105 stations, was 3.11 inches. The distribution was quite unequal, the largest amount reported being 7.89 inches at Atlantic, and the least .81 of an inch at Vinton. The rainfall was 1.48 inches below the June normal, but the ample supply of water stored in the soil in April and May prevented any injury to crops by the shortage in this month.

## OBSERVERS' NOTES.

*Amana*—C. SCHADT: Harvesting rye began on the 22d.

*Atlantic*—J. W. LOVE: Hail stones larger than hens' eggs fell for several minutes on the 5th.

*Atlantic (near)*—GEO. W. FRANKLIN: High wind from northwest at 11:30 P. M., 24th. Windmills, small buildings, etc., were destroyed.

*Bonaparte*—HON. B. R. VALE: A seasonable month and no heavy rains or storms, but a uniformly low barometer from May 10th to the close of June without much variation.

*Clinton*—DR. LUKE ROBERTS: June, 1896, was a very fine month. The growth and development of all products of the farm have been almost phenomenal. The same can be said of garden truck and most kinds of fruit. The apple crop seems not as great as in some years. Berries and grapes are abundant—the former of excellent quality and the latter promise to be. The vines seem much more vigorous and hearty than for several years.

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JULY.

The mean temperature of July, shown by reports from 102 meteorological stations, was 73.6°, which is .5° below normal. The highest temperature reported was 104°, at Malvern, on the 3d; lowest, 42°, at Elkader and Mason City, on the 9th and 16th.

The average rainfall for the state, as reported from 105 stations, was 6.90 inches, which is 2.60 inches above the normal. The bulk of this large amount of rainfall came in the last half of the month, causing much delay in completing harvesting and considerable damage to grain in shock and stack. The largest amount reported was 12.67 inches, at Moor, and the least amount, 1.61 inches, at Rock Rapids. It was an unusually wet July, especially unfavorable for harvesting and threshing small grain. Heavy showers with severe wind squalls were frequent in the latter part of the month.

## OBSERVERS' NOTES.

*Alta*—DAVID E. HADDEN: A destructive hail and windstorm passed through the north central part of Buena Vista county Sunday evening, the 26th, about 7 o'clock. The day had been peculiarly warm and oppressive, and during the afternoon a storm formed in the south. It passed over town in the shape of a gentle and refreshing shower. About half past 6 another storm formed in the northwest, the clouds being of a deep blue color. It swept along the northern horizon and disappeared to the northeast. Monday morning the news of a terrible hailstorm reached town. It entered the county on the west lines of Elk and Brooke townships, and was four miles in width. Crops were devastated, poultry and young stock killed or drowned, windows and roofs smashed by the falling hail. With possible exceptions, the crops on the four tiers of sections are

entirely destroyed. The storm continued through Scott and Lincoln townships with terrible destruction to everything in the shape of vegetation. It is estimated the damage in this county will reach the neighborhood of \$60,000. A number of the farmers affected by the storm carried insurance on their crop and stock. The Farmers Mutual of Buena Vista county is interested in several instances. It is very hard on some of the farmers who have been working all summer, and who see their work and expenditures come to naught in a few minutes.

In Cherokee and Plymouth counties the storm did a vast amount of damage, these counties being hit as hard as Buena Vista.

*Plover*—J. S. SMITH: Sunday night, the 26th, heavy north wind blew corn down quite bad. Eight miles south the wind did considerable damage to corn. There was also considerable damage done by hail during the storm.

*Portsmouth*—J. W. DAHLHEIMER: On the 26th, terrific windstorm accompanied with thunder and rain.

*Pringhar*—E. S. PROPER: Terrific windstorm on the evening of the 2d. Considerable damage done; barns, etc., blown down.

*Sidney*—G. V. SWEARINGEN: An electric storm on the night of the 27th. No damage done. Lightning almost continuous for about four hours; a few heavy peals of thunder. Considerable wind, which downed corn badly in many places; also upset and unroofed a number of corn cribs and outbuildings on the west of Nishna.

*Le Mars*—DR. T. E. COLE: A thunderstorm on the 26th was light in this city, but in northern, eastern and western parts of county was accompanied by heavy hail, doing a great amount of damage, laying small grain and corn, and killing poultry and hogs.

#### AUGUST.

The mean temperature for August was 71.7°, which is .7° above the normal for this month. The first half of the month brought the highest temperature of the season, the protracted heated term being phenomenally severe on account of the excessive humidity. The excess of temperature at the central station for the first fifteen days of the month was 64°, or more than 4° daily. The mean relative humidity for that period was 76 per cent. The last half of the month was cooler than the seasonal average, bringing the mean temperature of the month down to about the normal.

The average precipitation for the state was 3.52 inches, which is about the normal amount for August. The distribution was quite unequal, the northern districts receiving less than other sections. The highest amount reported was 12.25 inches, at Centerville, and the least quantity .86 of an inch, at Sioux City. Thunder and hailstorms of unusual severity occurred in numerous localities.

#### OBSERVERS' NOTES.

*Afton*—HON. N. W. ROWELL: Rivers and creeks all out on bottoms on the 14th; highest since July 5, 1888.

*Bonaparte*—HON. B. R. VALE: A poor month for saving the grain crop; vegetation, weeds and grass unprecedented. Closed favorable for maturing the corn crop.

*Corning*—JOHN W. BIXBY: Hot wind from the southwest on the 11th, which scorched leaves on the trees.

*Estherville*—M. L. ARCHER: On the 15th, severe electric storm with high wind, blowing down frail buildings and outbuildings. Grain stacks and corn blown down.

*Grand Meadow*—F. M. WILLIAMS: August 15th, a heavy thunderstorm, with wind and a little hail, did great damage to windmills, trees and grain stacks; also blew corn down badly. A peculiarity of the month was the bright days and bracing nights.

*Northwood*—A. L. THOMPSON: Excessive heat for this section 3d to 10th, inclusive.

*Ovld*—H. C. MILLER: Heavy thunderstorms on the 5th, 14th and 15th, with much destruction to property by lightning; six horses killed, more than twenty head of cattle and four barns destroyed. Several other buildings struck, some stacks damaged. Many meteors seen the nights of the 3d and 4th.

*Spencer*—F. E. WILLARD: Severe thunderstorms on the 14th and 15th. On the 15th lightning struck the German Lutheran church, setting fire to the roof and damaging the church about \$100.

*Toledo*—CHAS. MASON: About three inches of rain fell this month, accompanied by a great amount of electricity, doing much damage in striking and burning buildings, and killing, etc. No mention is made of any rodde buildings being struck, in the reports.

## SEPTEMBER.

The month of September was unseasonably cold and wet, with less than the average amount of sunshine. The mean temperature for the state was  $58.5^{\circ}$ — $3.5^{\circ}$  below the September normal. The highest temperature reported was  $95^{\circ}$  at Bonaparte on the 2d, and at Malvern on the 8th; lowest temperature reported,  $22^{\circ}$  on the 27th at Mason City. Severe and killing frosts occurred on several days in the last decade of the month.

The average precipitation was 4.09 inches—.39 of an inch above normal. The distribution was quite unequal, ranging from 9.96 inches at Moor to 1.82 inches at Iowa City.

It was an unfavorable month for ripening belated corn, and the early frost caught some of it in a premature stage.

### OBSERVERS' NOTES.

*Afton*—HON. N. W. ROWELL: Night of the 19th, first frost. No damage to vegetation. Twentieth, corn blades frosted; corn not hurt.

*Alta*—PROF. D. E. HADDEN: First killing frost of the season on morning of 19th.

*Bonaparte*—HON. B. R. VALE: A very dismal month. Vegetation kept green, and but little fall work accomplished.

*Clinton*—DR. LUKE ROBERTS: September, 1896, opened with three clear days, then two partly cloudy days, followed by two more clear days. The principal clear days during the balance of the month were the 19th to the 23d, both inclusive. The 19th and 20th were cold, the first frost of the season coming on the morning of the latter date. This was a killing frost, the temperature of the air dropping to  $31^{\circ}$ . Quite a heavy frost also

came on the 23d, with minimum temperature 33°. On the 28th a lighter frost occurred. No other frost during the month. The earliest autumnal frost during the last eighteen years was on the 8th of September, 1880, but was light.

*Cresco*—GREGORY MARSHALL: First killing frost occurred on the 20th. Ice formed.

*Grand Meadow*—F. M. WILLIAMS: The month has been cloudy and wet; corn all ripened before the frost came. Threshing is very slow with a good deal of wet grain. Fall feed is fine; spring seeding a good outlook.

*Larrabee*—H. B. STREVER: Vegetation killed by frost on the 19th.

*Logan*—MRS. M. B. STERN: The month has been rather cool; an unusual number of frosty mornings for September, and yet, away from the bottom lands, things are not badly killed.

*Sac City*—DR. CALEB BROWN: Light frost morning of 19th. Corn and tender vegetation bitten.

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### OCTOBER.

The month of October gave an average amount of clear and pleasant weather, although there was a slight excess of rainfall, which occurred during the periods as follows: from the 1st to the 5th, light and scattered showers occurred. Heavy and general rains occurred from the 9th to the 11th and from the 27th to the 30th, the remainder of the month being clear with about the normal October temperature. The average amount of rainfall was 3.13 inches—.28 of an inch above normal, and with few exceptions, was well distributed.

The average temperature for the state was 47.9°—1.6° below normal for the month. As there was but an average of 5 days on which .01 inch or more of precipitation fell, and 18 clear, and 6 partly cloudy days, it will be seen that the weather was favorable for fall plowing and harvesting of corn.

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### NOVEMBER.

The month was characterized by sharp reactions and wide ranges of temperature. The mean temperature for the state was 29.6°, which is 4 5° below the normal for November. Wintry weather prevailed for the most part during the last half of the month, with heavy snows in the northern districts of the state. Spirit Lake reported the lowest monthly mean, 19 2°, which is below the December normal.

The average range of temperature was 73.1°. The lowest temperature reported was 15° below zero at Rock Rapids on the 30th. Highest temperature, 82° at Belknap on the 16th.

The average precipitation (rain and melted snow) was 1.33 inches—.07 of an inch above normal. The largest amount reported was 4.51 inches at Spencer; least amount, .16 at Atlantic.

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### DECEMBER.

The month of December was unseasonably warm, the daily mean temperature for the state being 30.8°, which is 7° above the normal. The daily mean was 1.2° above the temperature of November. There have been few

warmer Decembers within the past twenty-five years. It was, in fact, too warm and murky at times for the best condition of public health.

The average precipitation was .65 of an inch — 1 inch below the normal amount for December. There was no snow within the limits of the state at the close of the month.

OBSERVERS' NOTES.

*Amana*—CONRAD SCHADT: Plowing went on the greater part of the month. At the close of the year the ground was free from frost and the river and creeks free from ice.

*Bonaparte*—HON. B. R. VALE: A rare December for all kinds of outdoor labor and for feeding stock. Cattle and horses have done well on meadows and pastures all fall.

*Delaware*—WILLIAM BALL: The month has been remarkable for high temperature, lack of sunshine and foggy weather.

*Grand Meadow*—F. L. WILLIAMS: The month was abnormally warm; ground bare most of the time and the roads either muddy or very rough. On the 31st the frost was nearly all out of the ground and the surface very wet.

*Hopeville*—M. T. ASHLEY: Total precipitation for 1896, 41.41 inches. Does anyone think Iowa is drying up?

*Lenox*—J. L. HURLEY: Ice out of ponds since the 28th. Thickness of ice for the month, 2 inches.

*Ovid*—H. C. MILLER: A warm rain on the 31st. Frost all out of the ground and grass growing. No ice on the ponds and streams. A very warm month, with an unusual number of foggy days and but light rains and snowfall.

*Carroll*—MOSES SIMON: December closed with a heavy rain, the frost nearly all out of the soil, and the roads in bad condition. Grass is turning green and it looks like spring.

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THE WEATHER AT CLINTON.

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DR. LUKE ROBERTS' ANNUAL REVIEW.

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During the first five days of the year 1896 an unusual cold wave prevailed. This storm spread over the entire United States, except the extreme southern portion of the Florida peninsula. This cold wave was not marked for its extreme severity in Iowa, as in many other portions of the United States. The lowest temperature at Clinton during these five days was 10° below zero, and the maximum velocity of the wind was 22 miles an hour during a portion of the 3d.

The balance of the month was warm, but cloudy. The mean temperature for the month was 25.5°, being 8.7° above a January normal. Storm days were few and the precipitation light. A fine misty rain and a dense fog were the closing phenomena of the month. Moderate temperature continued till the 15th of February. On the 18th a windstorm of great severity came from the west, bringing with it clouds of sand and dirt

gathered from exposed fields, and mixed it with the snow which it lifted from the ground, and the combination moving at a speed of 30 miles an hour yielded no tranquillity of mind to those exposed thereto.

The cold period of the month is included in the 11th, 12th and 13th. Precipitation was light and drouthy conditions prevailed at the close of the month. The first storm following—a snowstorm—was precipitated on the 8th of April, while the temperature ranged from 32 to 36°. This coating of snow after so many stormless days, proved a great blessing, and nicely prepared the way for the numerous gentle showers which followed.

A washout storm visited this vicinity on the 28th, doing some damage. The month was unusually warm and showery, resulting in favorable conditions for the early development of grass and seeded fields.

May continued the flattering conditions for the growth and maturing of crops, so that from the 4th of April to the close of May there was a continued warmth in the air above normal; and, with frequent showers, vegetation made a rapid and continuous growth. The hot spell in this month was from the 5th to the 13th inclusive, and during that time the maximum temperature was above 90° for seven consecutive days. The weather continued favorable for growing crops throughout the month of June, the result being phenomenal. All products of the farm and garden, apples, berries, grapes, etc., gave promise of a large yield and of excellent quality. The three months ending on the 30th of June, 1896, were warmer than any corresponding period during the last eighteen years. This was due to the abnormal heat of April and May, June not having contributed to swell the excess of heat. Much thunder and lightning prevailed in June, doing some damage.

An excess of rain was the prominent phenomena of July. Other meteorological conditions did not depart materially from the July normal. The precipitation on the 18th, 21st and 23d was very heavy, especially that of the 21st, yielding 2.30 inches of water, the greater part of which fell in twenty minutes time. A little hail accompanied this storm, and the wind attained a velocity of thirty-two miles an hour. This storm was damaging to oats. Farther up the river, the water, in its violent descent through ravines, carried away much dirt and occasionally a bridge. The heavy rains caused a shrinkage in the hay crop, but in no way interfered with pasturage.

It was conceded that the value of the excess of precipitation and warm days and much sunshine had been of such incalculable benefit in Clinton county that any damage which resulted from excess of water was merely nominal. The soil was once more supplied with needed moisture, and springs and wells again yielded their customary flow of sparkling water. The fields became green and beautiful in their freshness, the trees and shrubs appeared smiling at the prospect of a renewal of life and brightened foliage, and the husbandman was happy in the prospect of an overflow in his granaries.

August gave propitious weather for farming interests, and the outlook at the close of the month was satisfactory. Unharvested crops, with the exception of potatoes, were exceptionally promising. Corn was then looked upon as a great crop; and, when harvest time came, later in the



season, the forecast was verified. Threshing was practically completed at the close of this month. Some marked phenomena, however, characterized the month of August. Extremes in temperature and the frightful play of electricity deserve some notice. From the 26th of July to the 12th of August the heat was great, and comfortable sleeping places were at a premium. With the exception of a few single days, no more excessive heat prevailed.

Wind, rain and electricity were the elements which brought fright to the people and destruction of their property on the 6th, 11th, 13th, 15th and 22d. The work of these players brought a harvest of damaged roads, prostrated crops, trees broken and uprooted, windmills demolished, skylights broken, awnings and signs carelessly handled, buildings demolished, barns, farm implements and grain burned, and cattle killed, besides some mischief by fooling with electric wires. These storms were not confined to the city, but embraced the country. September furnished an excess of rain and cloudiness, and a deficiency of heat and sunshine. These were the conditions which caused the slow maturity of the enormous corn crop, which had all along been so promising. Pastures at the close of the month were never better at the same date of season. A deficiency in warmth continued through October, but an excess of clear days and absence of precipitation did much to save the corn and harden it. A copious rainfall on the 29th was the principal storm of the month.

November and December were each deficient in rainfall, and each gave a temperature above normal, but the latter was more marked than the former. December's epilogue to the drama of 1896 was excessive foggy, and "his gloom grew upon him."

#### CONSPECTUS.

Highest temperature, 97.5°, July 14th and August 8th.

Lowest temperature, 12° below zero, February 17th and 21st.

Extreme range of temperature, 109.5°.

Mean daily temperature, 49.4°.

Mean daily range of temperature, 21.6°.

Greatest mean monthly range of temperature, 25.4°, July.

Least mean monthly range of temperature, 15.5°, December.

Greatest daily range of temperature, 40°, March 30th.

Least daily range of temperature, 4°, December 6th.

Warmest month, July; mean temperature, 73.5°; 1.5° above that of 1895.

Coldest month, January; mean temperature, 25.5°.

Warmest days, July 14th and August 4th; mean temperature, 84.7°; 4.2° above that of 1895.

Coldest day, January 3d, 5.5° below zero.

Total number of days with maximum temperature 90° or above, 37; 8 in May, 7 of which were consecutive, from the 6th to the 12th inclusive; 7 in June, 14 in July and 8 in August.

Total number of days with the maximum temperature at 32° or below, 38; 9 in January, 9 in February, 5 in March, 7 in November, 8 in December.

Total number of days with the minimum temperature at or below 32°, 153; 30 in January, 27 in February, 26 in March, 9 in April, 1 in September, 10 in October, 23 in November and 27 in December.



Mean daily cloudiness, 46 per cent of the surface of the sky.

Months with the greatest per cent of cloudiness, January, 62, and December, 62.

Month with the least per cent of cloudiness, August, 33.

Total number of clear days, 142.

Total number of cloudy days, 110.

Month with the greatest number of clear days, August, 19.

Month with the least number of clear days, November, 7.

Month with the greatest number of cloudy days, January, 16.

Month with the least number of cloudy days, August, 3.

#### PRECIPITATION.

Total depth of snowfall, 27 inches.

Greatest fall of snow at any one storm, 9 inches, February 12th.

Total precipitation (rain and snow melted), 33.36 inches.

Greatest rainfall at any one storm, 2.30 inches, July 21st.

Month with the greatest precipitation, July, 7.13 inches.

Month with the least precipitation, November, .72 inch.

Month with the greatest number of storm days, September, 13.

Month with the least number of storm days, October, 2.

Total number of storm days, 96.

#### THE WIND.

Total movement of the wind, 42,100 miles.

Maximum velocity per hour, 32 miles in April, July and August.

Greatest monthly movement, 5,500 miles, in March.

Least monthly movement, 1,420 miles, in August.

Prevailing direction of the wind was from the west.

Observations taken at 7 A. M., 2 P. M. and 9 P. M., show the movement of the wind to have been from the north, 76 times; from the northeast, 143 times; from the east, 101 times; from the southeast, 101 times; from the south, 160 times; from the southwest, 173 times; from the west, 194 times; from the northwest, 150 times.

Maximum velocity for January, 24 miles an hour; for February, 30 miles; for March, 22 miles; for April, 32 miles; for May, 26 miles; for June, 20 miles; for July, 32 miles; for August, 32 miles; for September, 20 miles; for October, 16 miles; for November, 20 miles; for December, 22 miles.

#### SNOW AND FROST.

The last spring snow fell on the 8th day of April, 2 inches.

The first snow in autumn came on the 5th day of November. It was visible but not measurable.

The first snow to cover the ground made its arrival on the 3d of December and was about 1 inch deep. It disappeared the second day.

Last killing frost in the spring, April 10th. A light frost on the 22d.

First killing frost in autumn, September 20th.

Number of consecutive days without frost, 150; 13 more than in 1895.

The temperature of the air was at the freezing point or below for the last time in the spring, on the 10th day of April; 34 days earlier than in 1895.

The first in autumn, September 20th; 10 days earlier than in 1895.

The last day in spring when the mean temperature was below 32°, April 2d.

The first in autumn, October 24th.

## ELECTRIC METEORS.

Number of auroras observed, 1.

Number of days with thunder and lightning, 35; being 4 above normal.

## OPTICAL METEORS.

Number of solar halos observed, 1.

Number of lunar halos observed, 11.

Following is a table showing the yearly mean temperature, rainfall and movement of wind in miles for the years named:

YEARS.	Mean temperature in degrees.	Rainfall in inches and hundredths.	Wind movement in miles.
1879 .....	45.9	33.98	.....
1880 .....	47.7	37.02	.....
1881 .....	47.6	41.18	.....
1882 .....	47.8	41.98	64,442
1883 .....	44.0	38.71	63,566
1884 .....	45.7	43.04	54,114
1885 .....	43.8	38.21	54,693
1886 .....	46.6	23.71	44,263
1887 .....	47.2	34.01	53,110
1888 .....	45.1	35.76	56,300
1889 .....	43.1	32.18	48,720
1890 .....	48.6	31.86	51,890
1891 .....	48.3	33.87	48,625
1892 .....	46.4	40.73	43,890
1893 .....	46.2	30.39	51,600
1894 .....	40.8	27.47	50,040
1895 .....	47.2	30.38	45,090
1896 .....	49.4	33.36	42,010
Sums.....	845.4	632.82	772,353
Means.....	46.9	35.15	51,490

The above table shows the following facts: That the extreme range of the yearly mean temperature for the 18 years was 6°; that the greatest yearly mean was in 1894, and the least in 1885. That the total rainfall during 18 years was 52.73 feet. That the total number of miles the wind traveled during the last 15 years, at the speed it passed this city, was 772,353 miles, or an average of 990 miles per week, 6.30 miles an hour, and that the mean temperature for 1896 was 2.5° colder than an average of the last 18 years.

## RIVER STATISTICS,

Furnished by Harry A. Walden, of the Chicago & Northwestern railroad:

Ice started 7 A. M., March 20th, and at 10 o'clock the same morning the Mississippi river was practically clear of ice. The first boat to pass the bridge was the Chancy Lamb, going up at 4:25, March 26th.

The total number of boats which passed the bridge during the season

was 2,793—1,400 going up and 1,393 going down. There were also 370 barges and 828 rafts.

The river closed to navigation November 29th. November 28th, at 7 P. M., ice commenced to move, and blocked at 7:30 A. M., November 29th, but started again at 10:30 A. M., and ran until 8 A. M., November 30th, blocking solid. On December 9th the ice started again at 2:25 P. M., and stopped again after moving 100 feet, remaining closed until the 12th at 11:45 A. M., when a movement commenced, and after several days the river was free of ice. During this opening, the steamboat R. D. Kendall passed up at 7:35 A. M., December 30th. The river was clear of ice at the close of the year.

Water averaged low during the season, and was especially low during the months of January, February, March, April, August, September, October, and part of November and December. The lowest stage of water was .2 of a foot—March 20th. The highest was 13.5 feet, May 28th.

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## IOWA'S SOIL PRODUCTS.

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### REVIEW OF THE CROP SEASON, 1896.

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The crop season of 1896 in Iowa was characterized by an excess of heat and moisture, especially during the periods of seeding and harvesting.

The winter months were milder than usual, with less than the usual amount of precipitation, making favorable conditions for wintering stock. March was cool and dry, with frequent duststorms of considerable severity, causing delay and inconvenience in early spring work on the farms.

The first week in April brought a cold wave of considerable severity, with high winds and freezing weather on the 1st and 2d, and sharp frosts nearly every day until the 10th, which was the date of the last killing frost observed within the state. The second and third decades of the month were excessively warm and wet; the daily mean temperature for the state for the full month being 5.5° above normal, and the rainfall 2.42 inches in excess of the April average. The high temperature and frequent showers in the second and third decades pushed vegetation forward with unusual rapidity, and at the close of the month the season was rated ten days early. It was a notably favorable month for farm work and the germination of crops.

The mean temperature of May was 5.8° above the normal; and the records of the U. S. Weather Bureau stations within the state show that it was the warmest May since 1881. The average rainfall was 6.69 inches, which is 2.54 inches above the normal. The bulk of the rainfall occurred in the second decade of the month. Nearly all parts of the state suffered to some extent from excess of moisture, and from the effects of heavy windstorms accompanying the rainfall. The first decade of the month afforded generally favorable conditions for planting and cultivating corn,

and the outcome of the season approves the wisdom of those who vigorously pushed the work within that time. From the 10th to the 27th frequent showers and occasional heavy rains retarded field work in nearly all parts of the state.

The month of June was notably genial and favorable to all forms of life. The mean temperature was about normal, and the average rainfall was 3.11 inches, which is 1.84 inches below the normal for this state. But the ample supply of moisture stored in the soil by excessive rainfall in April and May prevented any injury to crops by the shortage in June. All crops made excellent progress, and conditions were favorable for field work. An unusually large acreage of hay was cut before the close of the month.

The mean temperature of July was about normal, and the average rainfall was 2.60 inches in excess. The first half of the month was generally fair; the latter half was showery and cloudy, with conditions generally unfavorable for harvesting and stacking the small grain crops. The oats crop, which at an early period was unusually promising, was badly damaged by rust and lodging before harvest, and its ruin was well nigh completed by excessive heat and moisture after it was cut and shocked. Other small grain crops were badly injured by the same unfavorable conditions.

The daily mean temperature of August was about normal, but the first half of the month brought the highest temperature of the season, and the protracted heated term was phenomenally severe on account of excessive humidity. The frequent showers and high percentage of humidity of the first half of August, following the excessive rainfall in the latter part of July, made the harvest season of 1896 one of the most unfavorable ever known in this state. Pastures, meadows, and vegetation generally were given a season of luxuriant growth, but the ripened grain crops suffered material damage.

The corn crop was unusually heavy and promising in the latter part of August, but the weather conditions in the last week of that month and the first half of September were unfavorable for ripening the late planted fields. The month of September was unseasonably cool and wet, with less than the average amount of sunshine; and heavy frosts in the last decade of the month brought the growing and ripening season to a premature close. The early planted fields, comprising the larger part of the corn crop, were fairly well matured and prepared for the advent of freezing weather. But the crop as a whole will not make the phenomenal yield that was promised in midsummer.

The season as a whole has been fairly good, and the growth of all kinds of vegetation has been phenomenally heavy. If the conditions had been as favorable for harvesting small grain, and for ripening the corn crop, as they were for the growth of grasses and other forms of vegetation, the summer of 1896 would have been notable among the seasons of great productiveness.

For study and comparison we give below a table showing the average rainfall in inches for Iowa, in the six crop months—April 1st to October 1st—for the years from 1890 to 1896, inclusive:

YEARS.	April.	May.	June.	July.	August.	September.	Totals.
1890.....	1.78	3.56	7.76	1.98	3.41	2.97	21.46
1891.....	2.15	3.18	5.39	4.22	4.24	1.33	20.51
1892.....	4.75	8.77	5.19	5.29	2.24	1.53	27.77
1893.....	4.21	3.45	3.91	3.33	2.38	2.24	19.56
1894.....	3.07	1.97	2.67	.63	1.58	3.57	13.89
1895.....	2.63	3.19	4.32	3.40	4.43	3.03	20.99
1896.....	5.08	6.69	3.11	6.90	3.53	4.09	29.33
Normals.....	2.60	4.15	4.95	4.30	3.60	3.70	23.30

The total precipitation for the state for the nine months ending September 31st has been 31.62 inches. The normal for that period is 28.22 inches, showing an excess for the year thus far of 3.40 inches.

JUNE CROP REPORT.

The crop season of 1896 was, on June 1st, about ten days early, compared with the average of former years. The high temperature and excessive rainfall in April and May, causing semi-tropical weather conditions, produced an abnormally rapid growth of vegetation. Seeding, planting and cultivating have been materially delayed by frequent showers and excess of moisture in the fields, so that farm work is generally belated, compared with the season of crop growth. Early planting has this season brought the best results, giving promise of the most abundant harvest.

Since June 1st there has been a material lowering of the condition of corn, oats, spring wheat and barley, on account of heavy rains in large portions of the state. If these reports had been made the 10th instead of the 1st they would undoubtedly be several points lower as to condition of cereals and acreage of corn. On the 1st a considerable area of land prepared for corn had not been planted, though it was included in the estimates of acreage. Some of this will not be planted this season and it is probable that on account of abandonment of wet fields the acreage of corn will this year be from 5 to 10 per cent less than in 1895. We shall call for a revised report of acreage of corn in the July report.

*Winter Wheat* — Compared with 1895 the acreage of winter wheat appears to be decreased 6 per cent, making a present acreage of 197,150 acres. Average condition, 94 per cent.

*Spring Wheat.*—Acreage increased 2 per cent, making present area 542,095 acres. Condition, 96 per cent.

*Corn.*—According to the state census report for 1895 the acreage of corn in 1894 was 8,648,804. Accepting this as the official basis of estimates, the acreage of corn planted this year is about 8,562,416. The condition June 1st was estimated at 89 per cent. We think that later investigations will show the acreage estimate to be too high.

*Oats*.—Acreage, 4,346,110; average condition June 1st, 101 per cent.

*Rye*.—Acreage 121,670 acres; condition, 98 per cent.

*Barley*.—Acreage 547,642 acres; condition, 99 per cent.

*Timothy and Clover*.—Show a slight decrease of area, the present acreage being about 2,250,960 acres; condition of timothy, 97; clover, 101 per cent.

*Millet*.—Condition, 98 per cent; considerable seeding after June 1st.

*Flax*.—Acreage, 199,128 acres; condition 96 per cent.

*Broom Corn*.—Acreage, 1,344 acres; condition, 95 per cent.

*Potatoes*.—Acreage reduced 8 per cent compared with 1895; probably about the same as in 1894, 170,285 acres; condition, 99 per cent.

*Sweet Potatoes*.—Condition, 97 per cent.

*Sorghum*.—Condition, 93 per cent.

*Fruit*.—Condition of apples, 87; pears, 76; plums, 59; peaches, 85; grapes, 90; blackberries, 91; raspberries, 95; strawberries, 89; currants, 71; cherries, 70.

*Live Stock*.—Cattle, 101; sheep, 100; hogs, 99; spring pig crop, 85; horses, 98; foals, 76.

Meadows are rated at 102 and pastures at 109 per cent.

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### JULY CROP REPORT.

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The month of June was generally favorable for the growth of the principal crops, the temperature being about normal, and the moisture sufficient for the needs of vegetation. The rank growth of oats and other spring grain crops, caused by the excessive heat and moisture of the preceding months, resulted in material injury by rust and lodging, the oats crop suffering the greatest amount of damage. The report shows an average decline of oats, 10 points; winter wheat, 3; spring wheat, 9; barley 2, and rye 5, as a result of the conditions referred to above. Corn has steadily gained and gives promise of attaining the normal standard.

The revised reports on the acreage of corn show it to be 98 per cent, compared with the area harvested in 1895. This would indicate a present acreage of 8,475,000 acres, on the basis of the state census returns for the year 1894.

The average condition of the staple crops July 1st is shown to be as follows:

Winter wheat, 91; spring wheat, 87; corn, 92; oats, 91; rye, 93; barley, 97; timothy, 95; clover, 100; millet, 95; flax, 94; broom corn, 91; potatoes, 100; sweet potatoes, 95; sorghum, 92; apples, 83; pears, 33; plums, 44; peaches, 88; grapes, 92 per cent.

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### AUGUST CROP REPORT.

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The reports of correspondents of this bureau for August make a fair showing as to the condition of corn and other growing crops. The weather was unseasonably wet during the last half of July, and while this was favorable to corn, grass and potatoes, the frequent showers were very damaging

to unstacked grain and hay. Oats suffered great injury, especially in the central and southern districts. The following figures show the average condition of the unharvested crops:

Corn, 98 per cent; millet, 97; flax, 97; broom corn, 95; potatoes, 91; apples, 89; grapes, 95; pastures, 103.

Threshing reports and estimates indicate an average yield per acre of harvested crops, as follows:

Oats, 26 bushels; winter wheat, 18; spring wheat, 14; rye, 16; barley, 28. Yield of timothy hay per acre, 1.6 tons; clover hay, 1.8 tons.

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### DECEMBER CROP REPORT.

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The general crop report for the season of 1896 is herewith submitted, showing average yield by counties of staple farm products, and average prices at stations nearest the farms on December 1st.

The estimates of total yield of the various crops for the state are made on the basis of the data contained in the Iowa census report for 1895, with estimates of increase or decrease of acreage in the years intervening since the crop season of 1894:

*Winter Wheat.*—The number of acres sown in 1894 and harvested in 1895, according to the census, was 209,613. There appears to have been a slight decrease in the acreage harvested in 1896, the number of acres this season estimated to be 197,150. Average yield, 17 bushels per acre; total bushels for the state, 3,351,550. Average price, 60 cents per bushel; value of product, \$2,010,930.

*Spring Wheat.*—Number of acres harvested, 542,095; average yield per acre, 13 bushels; total yield, 7,047,235 bushels. Average price per bushel, December 1st, 57 cents; total value, \$4,016,923.

*Corn.*—The total acreage of corn grown in Iowa this season is involved in some doubt. According to the census, the acreage in 1894 was 8,648,804 acres. I believe those figures are from 1,000,000 to 2,000,000 above the actual acreage of that year, but until the new census is made by the assessors in 1897, we must accept the official basis at hand. Estimating a decrease of about 7 per cent, we have this season 8,043,390 acres. The average yield is 39 bushels per acre; total product, 313,692,210. Average price, 14 cents per bushel; total value, if all sold at that price, \$43,916,904.

In quality the crop is somewhat disappointing. An unusually large per cent is soft and in poor condition to crib. The harvesting season has been quite unfavorable, and it is probable that above 20 per cent of the crop was still in the fields December 1st. Compared with the crop of 1895, the corn output of this season will fall short in feeding value fully 15 per cent. The yield per acre is heavier than usual.

*Oats.*—The acreage sown was about 4,346,000 acres. Prior to July 1st the condition of the crop was promising, but by the combined effects of blight, rust, lodging and unfavorable harvest weather, the output has been the poorest ever grown in Iowa. Of the total acreage seeded, not



more than 65 per cent was harvested and threshed, and a considerable percentage of the grain that was garnered was not worth the cost of harvesting and threshing. The average yield by measure of the area harvested appears to be 26 bushels per acre, which, by weight, would not exceed an average of 22 bushels. This, on an acreage of 2,825,000 acres harvested and threshed, would give a total yield of oats by measure of 73,450,000 bushels. The average price, 12 cents per bushel, worth December 1st, \$8,814,000.

*Rye.*—Acreage, 121,670; yield per acre, 16 bushels; total product, 1,946,720 bushels. Average price, 25 cents per bushel; total value, \$486,680.

*Barley.*—Acres harvested, 547,642; average yield, 29 bushels per acre; total product, 15,881,618 bushels. Average price, 20 cents per bushel; value, \$3,176,323.

*Buckwheat.*—Acreage, 8,740 acres; yield, 17 bushels per acre; total yield, 147,580 bushels. Worth, December 1st, \$61,983.

*Flax* —Acreage, 199,128 acres; average per acre,  $9\frac{1}{4}$  bushels; total product, 1,891,716 bushels. Value, \$1,135,029.

*Potatoes.*—Acreage, 170,285 acres; yield per acre, 87 bushels; product, 14,814,795 bushels. Value, \$2,962,959.

*Sweet Potatoes.*—Acres planted, 3,560; yield per acre, 81 bushels; product, 288,360 bushels. Value, \$201,852.

*Timothy Seed.*—Acres cut, 170,000; average yield, 3.8 bushels per acre; total product, 646,000 bushels. Value, \$678,300.

*Clover Seed.*—Number acres cut, 61,000; average yield, 2 bushels per acre; product, 122,000 bushels. Worth, \$396,500.

*Sorghum.*—Acres planted, 19,000; average yield per acre, 90 gallons; total yield, 1,710,000 gallons. Worth, \$615,600.

*Hay (tame).*—Acres, 2,250,960; average yield,  $1\frac{1}{2}$  tons per acre; total, 3,376,440 tons. Value, \$15,193,980.

*Prairie Hay.*—Acres cut, 1,550,000; average yield,  $1\frac{1}{2}$  tons per acre; total product, 2,325,000 tons. Value, \$7,672,500.

*Millet and Hungarian Hay.*—Acres cut, 90,000. Value, \$540,000.

*Hungarian and Millet Seed.*—Estimated value, \$50,000.

*Broom Corn.*—Average yield, .8 of a ton per acre. Value of product, \$48,160.

*Vegetables and Roots.*—Estimated value, \$475,000.

*Nursery Stock.*—Sold, \$230,000.

*Apples.*—Value of product (estimated), \$2,500,000.

*Grapes and Other Fruits.*—Estimated value, \$845,000.

*Market Garden Products.*—Value, \$370,000.

Average farm prices of horses, \$37 per head; milch cows, \$26; wool, 11 cents per pound.

The amount of fall plowing compared with average is 83 per cent.

The honey crop is 93 per cent of an average, and is worth \$91,000.





TABLE SHOWING AVERAGE YIELD BY COUNTIES—CONTINUED.

CRAZE YIELD PER ACRE BY COUNTIES.												
COUNTIES.	Barley, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed, bu.	Flax seed, bu.	Broom corn, tons.	Irish potatoes, bu.	Sweet potatoes, bu.	Sorghum, gals.	Buckwheat, bu.	Tame hay, tons.	Prairie hay, tons.
Carroll	24	5.0	2.0	14	9	20	77	81	45	15	1.8	1.8
Cass	21	3.3	1.7	15	8	100	82	90	93	12	1.6	1.3
Cedar	23	3.4	1.8	15	8	75	75	70	70	16	1.7	1.4
Cerro Gordo	23	3.4	2.2	28	10	75	75	106	15	14	1.4	1.4
Cherokee	20	2.0	1.0	30	10	75	61	50	72	15	1.6	1.1
Chickasaw	11	4.0	1.6	30	10	75	100	200	200	21	1.8	1.8
Clarke	11	2.9	1.8	30	10	75	93	200	200	21	1.8	1.8
Clay	20	2.4	1.8	30	10	75	93	200	200	21	1.8	1.8
Clayton	13	5.3	2.7	30	10	75	93	200	200	21	1.8	1.8
Clinton	25	3.3	1.8	16	13	90	81	60	52	17	2.2	1.8
Crawford	13	4.0	1.8	16	13	90	81	60	52	17	2.2	1.8
Dallas	10	2.3	1.6	22	8	5	108	150	150	15	1.6	1.3
Davis	10	2.5	2.0	22	8	5	108	150	150	15	1.6	1.3
Decatur	10	2.5	1.5	8	5	69	49	72	14	1.7	1.2	1.2
Delaware	13	3.0	1.7	28	8	111	150	80	19	1.4	1.2	1.2
Des Moines	13	3.9	1.5	28	8	113	100	120	18	1.4	2.0	2.0
Dickinson	11	3.5	1.5	28	8	83	83	100	120	18	1.4	1.5
Dubuque	10	3.5	1.5	15	8	84	84	40	40	10	1.4	1.0
Emmet	14	4.5	2.0	30	11	130	79	80	80	14	1.6	1.6
Fayette	14	4.3	2.0	30	12	79	79	80	80	14	1.6	1.2
Floyd	14	3.7	2.0	14	14	63	63	75	75	20	1.6	1.3
Franklin	10	3.0	3.2	18	10	66	66	103	103	15	1.7	1.0
Fremont	18	4.5	2.0	8	9	42	42	48	48	19	1.9	2.0
Greene	11	3.5	2.4	30	9	69	69	100	77	7	3.0	1.4
Grundy	15	4.0	1.4	11	11	145	78	63	50	16	3.5	1.3
Guthrie	28	3.2	1.2	11	8	78	78	63	42	14	2.0	1.4
Hamilton	15	3.8	2.0	10	8	64	64	70	70	23	1.5	1.1
Hancock	12	3.6	2.2	30	10	54	54	70	70	23	1.8	1.5
Hardin	14	2.5	2.1	20	10	77	77	80	80	11	1.8	1.4
Harrison	20	2.0	2.0	20	10	66	66	60	60	15	1.5	1.8
Henry	20	3.2	1.5	20	10	81	81	50	80	16	1.8	1.0
Howard	15	3.0	1.5	19	11	77	77	40	40	18	1.7	1.6
Humboldt	18	3.0	2.5	11	11	78	78	95	95	20	1.6	1.3
Ida	18	3.0	1.8	20	11	80	80	75	75	19	1.9	1.7
Iowa	10	4.5	2.0	35	...	144	85	135	135	20	2.8	3.6
Jackson	15	3.0	1.0	...	...	142	81	55	80	20	1.7	...
Jasper	15	2.8	1.6	12	...	1.5	81	55	80	7	1.9	1.6
Jefferson	15	2.7	1.7	20	...	5	68	63	105	29	1.8	1.5
Johnson	12	3.4	1.8	...	...	...	128	63	160	29	1.7	1.5
Jones	10	3.3	...	30	...	...	108	...	73	23	1.7	1.3
Keokuk	10	3.5	2.8	...	...	...	101	50	91	10	1.7	...
Kossuth	20	4.0	2.8	...	10	...	82	...	112	15	1.6	1.1
Lee	10	2.0	1.6	8	...	1.0	82	138	83	11	1.3	...
Linn	12	4.3	1.8	...	...	...	132	100	72	20	1.6	1.7
Louisa	10	5.0	2.0	...	...	...	88	84	66	10	1.5	2.0
Lucas	10	2.7	1.4	...	...	...	101	50	101	26	1.3	1.0
Lyon	10	4.0	1.8	18	12	...	120	...	...	...	1.4	1.6
Madison	10	4.2	1.7	20	...	...	93	60	74	13	1.8	1.4
Mahaska	10	2.5	2.5	...	...	...	82	100	85	...	1.6	1.5
Marion	15	5.9	2.1	8	...	...	82	62	140	23	1.7	1.7
Marshall	12	4.3	1.4	49	9	...	91	...	93	23	1.8	1.2
Mills	12	4.0	4.0	30	...	...	100	150	40	...	2.0	1.6
Mitchell	12	4.3	1.8	14	11	...	78	...	64	17	1.6	1.2
Monona	11	4.0	1.5	29	...	...	90	50	87	12	1.4	1.4
Monroe	10	3.5	1.6	18	...	...	60	25	20	10	1.2	...
Montgomery	10	5.5	1.8	...	...	...	150	...	...	...	1.5	1.3
Muscatine	15	6.2	2.0	...	...	...	104	138	97	...	1.3	...
O'Brien	15	4.0	...	...	8	...	75	...	...	...	2.1	1.5
Osceola	12	4.0	...	10	10	...	93	...	...	...	1.8	1.5
Page	10	4.3	1.8	...	...	...	98	150	...	...	1.9	2.0
Palo Alto	15	3.1	...	8	11	...	84	...	...	12	1.4	1.2
Plymouth	27	5.5	1.2	24	10	...	90	...	85	...	1.6	1.5
Pocahontas	27	2.5	1.2	33	8	...	52	...	114	21	2.0	1.4
Polk	27	3.7	2.3	34	...	3	71	67	91	23	1.6	1.4
Pottawattamie	28	3.8	2.4	19	...	...	71	55	97	17	2.0	2.2
Poweshiek	22	3.5	1.6	...	...	...	102	200	62	...	1.6	1.5
Ringgold	20	4.2	1.3	20	...	...	74	76	119	17	1.6	1.5

TABLE SHOWING AVERAGE YIELD BY COUNTIES—CONTINUED.

COUNTIES.	AVERAGE YIELD PER ACRE BY COUNTIES																
	Winter wheat, bu	Spring wheat, bu.	Corn, bu.	Oats, bu.	Rye, bu	Barley, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed, bu.	Flax seed, bu.	Broom corn, tons.	Irish potatoes, bu.	Sweet potatoes, bu	Sorghum, gals.	Buckwheat, bu.	Tame hay, tons.	Prairie hay, tons.
Sac .....	12	40	27	15	32	4.0	1.8	40	6	.....	78	.....	80	20	2.0	1.6	
Scott .....	18	14	49	39	11	24	8.9	2.2	29	.....	102	138	80	15	1.5	1.6	
Shelby .....	15	45	25	..	20	7.0	1.5	20	.....	.....	60	.....	.....	.....	2.0	.....	
Sioux .....	15	38	28	29	35	4.0	3.0	.....	12	.....	65	.....	.....	.....	1.5	1.2	
Story .....	21	17	37	33	17	31	3.5	1.7	28	10	.....	82	100	88	20	1.8	1.4
Tama .....	25	13	42	24	16	23	4.0	3.0	9	.....	129	60	135	16	2.0	1.8	
Taylor .....	18	9	35	24	17	..	3.2	1.7	.....	.....	68	73	.....	22	1.7	1.6	
Union .....	18	13	36	15	14	..	3.1	1.2	.....	.....	73	70	69	15	1.6	1.2	
Van Buren.....	15	..	40	26	11	..	2.6	1.9	.....	.....	82	50	50	17	1.4	.....	
Wapello.....	15	..	45	31	16	..	4.2	2.5	10	.....	119	80	92	.....	1.4	.....	
Warren.....	16	12	44	19	15	..	3.0	2.1	8	.....	9	92	63	91	.....	1.7	1.3
Washington .....	17	..	45	28	14	..	4.2	2.1	.....	.....	75	60	80	.....	1.8	.....	
Wayne.....	14	14	36	22	14	..	2.7	1.7	19	6	.....	54	45	82	30	1.8	1.5
Webster.....	25	16	40	32	20	30	4.0	3.1	17	8	3	84	.....	100	18	1.8	1.4
Winnebago .....	..	16	38	36	18	30	5.0	3.0	.....	10	.....	114	.....	.....	18	1.8	1.2
Winneshek.....	11	13	43	31	17	34	4.7	1.9	.....	12	.....	83	.....	105	16	1.7	1.3
Woodbury.....	..	17	34	30	..	22	1.8	.....	10	12	.....	48	.....	.....	15	1.5	1.8
Worth .....	..	8	30	35	..	28	6.0	5.0	..	10	.....	60	.....	.....	..	2.0	1.5
Wright .....	..	12	34	29	17	26	4.3	2.6	16	9	.....	64	.....	85	9	1.5	1.5
Averages....	17	13	39	26	16	29	3.75	2.0	19	9.5	8	87	81	90.5	17	1.5	1.5

LOSS BY HOG CHOLERA IN IOWA.

FROM MONTHLY REVIEW FOR NOVEMBER.

“What percentage of hogs have been lost by cholera?” This inquiry was appended to the blanks sent out to the crop correspondents of the Iowa Weather and Crop Service, and their answers are embodied in the final report of the season. The percentages of loss given have been carefully tabulated, and the result is summarized below.

The average for the state appears to be 30 per cent, which is believed to be approximately correct; certainly not too high. There is a marked variability in the ravages of the disease, the range by counties being from 2 per cent to 77 per cent.

Following are the averages by districts; Northeast district, 7 counties, loss 7 per cent; East Central district, 14 counties, loss 14 per cent; Southeast district, 10 counties, loss 11 per cent. The three eastern districts, comprising 31 counties, lying eastward of a line drawn from west lines of Howard to Davis, show an average loss of only 11 per cent.

North Central district, 14 counties, loss 38 per cent; Central district, 15 counties, loss 52 per cent; South Central district, 13 counties, loss 30½ per cent. The three central districts, comprising 42 counties in a north and south belt, show an average loss of 40 per cent.

Northwest district, 10 counties, loss 16 per cent; West Central district,



9 counties, loss 27 per cent; Southwest district, 8 counties, loss 24 per cent. For the western belt, 27 counties, comprising the Missouri slope, the average has been 22 per cent.

From this it will be seen that the disease has caused the greatest loss in the central belt, about five counties wide; across the state from north to south. See map above, giving percentage by counties.

The loss to the state is very heavy. Probably the aggregate will amount to 1,800,000 hogs, of all ages, but mostly less than a year old. The indirect loss is also very heavy, on account of the shipment and slaughter of vast numbers of young animals in various stages of immaturity.

The aggregate loss to the state, direct and indirect, can not fall short of \$15,000,000 for this single season.

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## WEATHER CROP BULLETINS.

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### SUMMARIES OF WEEKLY BULLETINS FOR THE CROP SEASON 1896.

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#### BULLETIN NO. 1, APRIL 7TH.

The past winter was milder than the average with less than the normal amount of precipitation and stormy weather, making favorable conditions for wintering stock. March was abnormally cool and dry, with frequent duststorms.

April came in with a cold wave of considerable severity, with high winds and freezing weather on 1st and 2d, retarding farm work. The temperature has been below normal for the past week. The season is somewhat late compared with the average of recent years. But a fair start has been made in seeding and preparing ground for planting. In the southern districts seeding small grain is about completed. In the central and northern districts sowing spring wheat is nearly completed, with a small increase of acreage compared with last year, and considerable progress has been made in sowing other small grain.

The soil is in fine condition for working and for the reception of seed, with sufficient moisture to start vegetation. While the subsoil is extremely dry, there is more moisture at the surface than at the corresponding date last year. Fall wheat and rye wintered fairly well, but were somewhat injured by the high winds and freezing weather of the past week. Pastures and meadows come out in good shape, except some damage to clover from the dry weather in the fall. Stock is generally in good condition, and there is an ample supply of forage on hand.

#### BULLETIN NO. 2, APRIL 14TH.

The past week brought a rare variety of weather, with a notable comingling of winter and summer conditions. A general storm began on the 7th and continued until the 9th, the precipitation in many localities in the northern and central districts taking the form of snow, sleet, hail and rain, the temperature being near the freezing point. This was followed by much warmer weather, with frequent scattered showers, the maximum temperature ranging from 75° to 90°.

Reports from all parts of the state show that the drouth has been effectually broken, the measurements of precipitation ranging from one to four inches. There is ample moisture in all sections and in many localities the soil is thoroughly soaked. The bulk of the precipitation has been absorbed by the thirsty earth. Farm work has been delayed and

some seeding of small grain remains to be done in nearly all districts. A fair start has been made in plowing for corn. Farmers are pushing things on all lines with renewed confidence. Grass has made a vigorous start. In the districts where winter wheat is grown reports are generally more favorable. There are indications of an increased acreage of spring wheat, compared with last year, and a probable decrease in the acreage of oats. More than the usual amount of grass seed is being sown. Fruit buds are swelling and no damage is reported.

BULLETIN NO 3, APRIL 21ST.

The high temperature and abundant rainfall of the past two weeks have brought the season forward rapidly to normal conditions, and in some respects it is now in advance of the average. The past week was unusually warm, and all conditions were favorable for farm work and the growth of vegetation. The daily mean temperature ranged from 3° to 15° above normal, the least excess being registered in the northwest section. The rainfall, in form of light showers, was ample to maintain sufficient soil moisture for present needs. Seeding of small grain is now practically completed and fair progress has been made in plowing for corn. With continuance of favorable weather, planters will be in operation before the close of the month. Early sown grain is up, and generally shows a good stand. Spring wheat is especially promising, and winter wheat is generally in good condition in the central and southern districts. But one report has been received of extensive damage to this crop. Pastures and meadows have made rapid growth, and in some sections pasturage is ample for the support of stock. Early varieties of fruit are in bloom in the southern districts, and in all districts the prospect is excellent.

BULLETIN NO. 4, APRIL 28TH.

The daily excess of temperature during the past week ranged from 3° to 9°, and there was an average amount of sunshine. The rainfall was considerably above the normal in the northern and central districts. For the month of April the total precipitation is now from 1 to 3 inches above the normal for the state at large, and in all sections there is an ample reserve of moisture in the soil and subsoil. These favorable conditions have brought all forms of vegetation forward with unusual rapidity, and in respect to the growth of plants and foliage the season is now earlier than the average. Oats, barley, spring wheat, fall wheat and rye have been greatly benefited, and in all sections of the state pasturage is now ample for the support of stock.

Farm work has been vigorously pushed and a large area is ready for planting. Some corn has been planted in the southern districts, and with favorable weather this work will be quite general within the coming week. A good beginning has been made in planting potatoes. The light frosts reported on the mornings of the 22d and 23d did no damage, and the fruit prospects continue to be quite promising.

BULLETIN NO. 5, MAY 5TH.

The average temperature for the state during the past week was a little above normal, much the greater excess being recorded in the southern districts. The percentage of sunshine was generally far below the normal. The reports show excessive rainfall in the larger part of the

state, the lowest measurements being recorded in the south central and southeast districts. Following are some of the highest figures reported: Plymouth, 5.01 inches; Woodbury, 3.93; Webster, 3.52; Osceola, 3.32; O'Brien, 3.22; Jasper, 3.38; Black Hawk, 3.60; Wright, 3.03; Harrison, 3.18; Carroll, 2.58; Crawford, 2.62; Marshall, 2.15; Buchanan, 2.02; Humboldt, 2.20; Franklin, 2.21; Bremer, 2.76; Howard, 2.53; Ida, 2.38; Tama, 2.84. These figures show a wide distribution in the northern and central districts. But there are no complaints of superabundant rainfall, and there are comparatively few reports of damage caused by the heavy storms of the week. It may therefore be set down as another favorable week in this most promising season. Small grain and grasses are doing remarkably well in all sections. Pasturage is abundant, and the hay crop promises to be unusually heavy. Plowing and planting were retarded by the wet weather in all sections where there was an excess of moisture. In the southeast, and portions of other southern districts, about half the usual acreage of corn has been planted; and in all of the southern half of the state a good beginning has been made. Within the coming week, if weather is favorable, the planting operations will be general.

BULLETIN NO. 6, MAY 12TH.

The past week was unseasonably hot and generally dry, with more than an average amount of sunshine and high winds. The daily excess of temperature ranged from 8° to 12°. For the week ending Saturday, the rainfall was but little more than a trace in the larger part of the state. Later reports by wire and mail show that the light showers on Sunday evening extended over a considerable area in the central and northern districts. The southern districts are in pressing need of moisture for the pastures and small grain crops. Conditions were generally favorable for corn planting, and good progress is reported in all sections. In the central and southern districts the work is nearing completion, and by the close of the coming week it will be practically finished in all parts of the state. Early planted corn germinated readily, showing a good stand and color, and the work of cultivation is already well begun in some localities. Grass and small grain have made good advancement, and with timely rains will fulfill their early promise. Chinch bugs are beginning to cause some anxiety in some parts of the southern districts.

BULLETIN NO. 7, MAY 19TH.

The past week was excessively wet and cloudy, with about the normal temperature. Showers have fallen in considerable portions of the state every day since the 9th inst., and in all districts there has been a heavy excess of rainfall. Following are some of the higher measurements reported for the week ending Saturday night: Pottawattamie, 7.75; Carroll, 7.57; Boone, 6.59; Greene, 6.50; Ringgold, 6.36; Mills, 5.26; Union, 5.15; Fremont, 4.31; Osceola, 4.40; Woodbury, 4.41; Ida, 4.15; Wright, 4.89; Cherokee, 4.82; Buena Vista, 5.87; Winnebago, 4.50; Dallas, 3.42; Jasper, 3.34; Palo Alto, 3.28; Davis, 3.60; Tama, 3.66; Marshall, 2.95; Bremer, 3.29; Washington, 3.17; Iowa, 2.82; Clay, 3.93 inches. Adding the heavy showers of Sunday and Monday would give a very great excess during the past ten days. Considerable damage to crops has been done by washing out and flooding in some localities where the heavier downpours occurred.



Corn planting has been retarded, and probably some replanting will be necessitated. In the northern and central districts from 20 to 40 per cent of the corn area remains to be planted, and in some sections the plowing is not completed. The early planted fields show a fair stand, but the weeds are getting a vigorous start. Grass and small grain have made a phenomenal growth. The only drawback is a tendency to rank growth of oats and wheat, which may cause damage by lodging or rust. The hay crop is assured, and will be unusually heavy.

BULLETIN NO. 8, MAY 26TH.

First of the week was cool and cloudy, last half warm, the mean temperature for the week being above normal. The rainfall was generally light during the working days of the week, and the time was well improved wherever the soil was dry enough to plow or plant. Considerable ground remains to be planted in all sections where the rainfall was excessive and the surface low and flat. The acreage planted on bottom lands will be materially lessened. Some progress has been made in cleaning out the early planted fields, but the weeds have made a rapid growth. Cutworms are numerous. The excessive heat and moisture of the season has not been altogether favorable to the best development of small grain crops, especially in sections where the rainfall has been heaviest. Oats and spring wheat show a tendency to become too rank, and there are some reports of lodging. Pastures, meadows, garden vegetables and small fruits are generally excellent.

BULLETIN NO. 9, JUNE 2D.

The temperature the past week was variable, the average for the state being above normal, and the sunshine generally deficient. The rainfall for the week ending Saturday night was unequally distributed, ranging from less than .50 to above 3.50 inches. The heaviest downpours are reported from portions of the east central and northeast districts, where local cloudbursts caused destructive floods. In the larger part of the state the work of planting has been retarded by excessive moisture, and a small percentage of the usual corn acreage remains to be planted. Drying weather is needed to put the soil in condition for completing the work of planting and replanting, and for subduing the weeds that have made a vigorous start in early planted fields. The average condition of all field crops, except grass, has been somewhat lowered by excessive rains. Winter wheat and rye appear to be doing fairly well. Oats, barley and spring wheat show some ill effects of wet weather. But, with favorable weather in the future, all crops may regain their former promising condition. Pastures and meadows are at their best.

BULLETIN NO. 10, JUNE 9TH.

The first half of the week was cool, the last half warm, making the average temperature about normal. There was a large excess of cloudiness, with frequent light showers in many localities, hindering farm work in fields not well drained. On the 5th considerable local damage was caused by cloudbursts in Harrison and Cass counties. Variable reports are received as to the condition of corn. Early planted corn on drained land is doing fairly well, and is well cultivated. The general condition of this crop, however, is below the seasonable average, and the acreage has been



lessened by the excessive moisture. In numerous localities planting is not yet completed, and many fields are weedy. Oats and spring wheat are becoming rank, with a tendency to rust, the result of excessive heat, humidity and rainfall. Fall wheat is doing fairly well. Pastures are luxuriant. Timothy and clover meadows are unusually heavy where the stand is good. In old meadows the yield of hay will be much reduced by the encroachment of blue grass. Army worms have appeared in great numbers in numerous localities, their destructive work being mainly done in grass lands.

BULLETIN NO. 11, JUNE 16TH.

The daily mean temperature of the past week was from 3° to 5° below the seasonal normal, and the sunshine was less than the average. The rainfall was unequally distributed; but all sections received an ample supply, and some localities still report an excess of moisture. The lower temperature has been beneficial in checking the tendency of oats, wheat and barley to rust and lodge, from which these crops have been materially damaged in all sections of the state. Considerable progress has been made in cleaning the corn fields, and the crop is doing fairly well in well drained fields. The planting season has covered a period of over six weeks, and there is a wide range in the size and general condition of the plant. Clover cutting is in progress in all districts, and some timothy meadows have been cut. Clover is heavy, and new meadows generally promise a liberal yield of hay. All reports indicate a light crop in the old meadows. Potatoes and pastures are heavy.

BULLETIN NO. 12, JUNE 23D.

Ideal weather conditions prevailed the past week in the larger portion of the state. The daily mean temperature ranged from 3° to 5° above the seasonal normal, and the amount of sunshine was sufficient. The rainfall was generally light, except in portions of the north central, northeast and east central districts, from which reports are received of heavy local showers. There has been but slight interference with farm work, and good progress is reported in the cultivation of corn and hay making. Corn is generally clean, and in some of the southern districts the early planted fields are being laid by. The corn fields and clover meadows are pushing the farmers, and the harvest of fall grain is close at hand. Some improvement is noted in the prospects of spring grain, especially in sections where dry weather has prevailed, which has checked the tendency to lodge and rust. Complaints of predatory insects have about ceased, and the general tone of reports is more cheerful.

BULLETIN NO. 13, JUNE 30TH.

The temperature of the past week was favorable for all crops, although slightly below the seasonal normal. The rainfall was unequally distributed, numerous localities reporting heavy thunderstorms, with wind squalls of considerable force, on the 24th and 25th. In all sections there is an ample supply of moisture in the soil for the present needs of the crops. Reports from all districts indicate that corn is making good advancement, and a large portion of the crop will be laid by during the coming week. The late planted and replanted fields give promise of producing a fair crop. Oats suffered material injury in all sections visited by

heavy rain and windstorms, a portion of the rank grain being lodged beyond recovery. The full extent of damage cannot as yet be estimated. There are numerous reports of damage to spring wheat by rust. The harvest of hay and fall grain is in progress, and a considerable acreage of barley is about ready for the reaper. The yield of hay is generally satisfactory. Pastures yield abundantly, and the prospect for potatoes was never better.

## BULLETIN NO. 14, JULY 7TH.

The high temperature prevalent during a portion of the past week was modified by more than the normal amount of humidity and cloudiness, and timely showers favored the rapid growth of vegetation. The rainfall was generally sufficient, and numerous localities report amounts much above the seasonal normal. The widely extended rain and windstorms on the 2d and 3d caused a material increase of damage to oats and spring wheat by lodging and rust wherever the growth of straw is excessively heavy. Corn has made fine progress in all sections, being mostly laid by in good condition. The harvest of winter grain is practically finished; the cutting of barley is general, and, in the southern districts, the oats harvest is begun. Hay making has been delayed in some localities by cloudy and damp weather. Hay crop generally heavy, but the acreage is below the average of former years.

## BULLETIN NO. 15, JULY 14TH.

The past week was cool and dry. The daily average temperature was about 3° below normal, and the rainfall barely exceeded a trace in any part of the state. The days were generally bright and warm, but the nights were cool. It was ideal harvest weather. Hay is generally well secured; the winter grain crops are in the stack or threshed; barley is about all cut in the southern and central districts; the oats harvest is in progress in all sections, the ripening being hastened by rust.

All reports show extensive damage to oats by rust and lodging, and in the southern and central districts the prospective yield will scarcely repay the harvesting of a large percentage of the area planted. The northern districts suffered least damage from that cause, but the yield will be cut short in all sections. Spring wheat has been materially injured by rust, but the condition of that crop is much better than that of oats. Corn has made steady advancement in all districts, and its condition is now well up to the normal. Rain is needed in moderate quantities for the pastures, potatoes, corn, and the minor crops, though no material damage has yet resulted from the dry weather of the past ten days.

## BULLETIN NO. 16, JULY 21ST.

From the 13th to the 16th the weather was excessively hot and dry, causing some apprehension of damage by hot winds and drouth. This heated term was followed by much cooler weather and copious showers fairly well distributed. The southern and central districts received the heaviest amount of rainfall, the reported measurements ranging from one to five inches. These showers came in good time, and have been of immeasurable benefit to corn, late potatoes, pastures, gardens and all immature crops. The reports show that good progress has been made in the harvest fields, and by the close of the present week the bulk of small

grain will be in shock or stack. Threshing from shock has been begun in all districts with quite variable results. All reports agree that oats are both short in quantity and deficient in weight. Judging by returns thus far received the output for the state will be less than one-third the heavy yield of 1895. Corn is very promising, and received no material damage from the late hot and dry weather.

BULLETIN NO. 17, JULY 28TH.

The week ending Monday, the 27th, was unusually cool from the 22d to the 26th, and the amount of rainfall probably exceeded the aggregate received during any week of the current season. The special corn and wheat stations report the following amounts: Marshalltown, 5.07 inches; Hampton, 3.32; Clinton, 4.41; Charles City, 1.59; Fairfield, 2.53; Maquoketa, 3.53; Iowa City, 2.69; Forest City, 1.40; Waterloo, 4.46; Ogden, 4.08; Cedar Rapids, 3.40; Osceola, 4.21; Centerville, 3.65; Des Moines, 3.67. Numerous other stations give similar reports. This has made very unfavorable conditions for harvesting and threshing, and grain in shock has suffered material injury. Oats received the greater damage, reducing still lower the condition of this unfortunate crop. A short period of dry weather is now much to be desired, to give opportunity to save the unstacked grain. Corn is generally reported in good condition, and there is an ample storage of moisture in the soil to develop and ripen the early and late planted fields. The weather has been very favorable for late potatoes and pasturage, and all immature vegetation.

BULLETIN NO. 18, AUGUST 4TH.

The temperature of the past week was about normal, but the rainfall was excessive and amount of sunshine deficient. For the week ending August 1st, the following are among the heavier amounts of rainfall reported: Dubuque, 5.84 inches; Shelby, 5.13; Butler, 4.85; Jasper, 4.76; Poweshiek, 4.68; Delaware, 4.53; Boone, 4.15; Story, 3.93; Marshall, 3.85; Iowa, 3.53; Carroll, 3.44; Black Hawk, 3.58; Polk, 3.53; Van Buren, 3.49; Tama, 3.31; Jackson, 3; Bremer, 3.33; Woodbury, 2.85; Lee, 2.92; Muscatine, 2.50; Clayton, 2.65; Guthrie, 3; Webster, 2.85; Crawford, 2.54; Pottawattamie, 2.35.

The weather conditions have been very unfavorable for completing the work of stacking and threshing from the shocks. And as a result of the frequent and heavy rains of the past two weeks the unsecured grain has been materially injured by rotting and sprouting. Oats suffered the greater damage, but spring wheat has also been badly hurt. Numerous reports state that stacks of grain have been considerably injured by excessive downpours and heavy winds. Corn is doing notably well, except in some localities where it was broken down by wind and hailstorms on the night of the 26th. On the whole this crop is very promising, and the bulk of it is now in the roasting ear stage. Pastures and meadows show a luxuriant growth.

BULLETIN NO. 19, AUGUST 11TH.

This has been the warmest week of the season, the daily mean temperature ranging from 5° to 8° above normal. The rainfall was very light during the working days of the week, with the exception of heavy local showers in Appanoose county and some other portions of the south central district. On Saturday night and Sunday night the high temperature

was somewhat alleviated by showers with high winds, extending over the greater portion of the state. Some damage to corn is reported from various localities, but the aggregate of loss will not be heavy. Considerable progress has been made in securing the unstacked grain, and threshing has been resumed with varying results. Corn is generally doing remarkably well. The greater portion of the early planted corn is well advanced in the roasting ear stage, and much of it bids fair to be ripe enough to cut before the close of August.

BULLETIN NO. 20, AUGUST 18TH.

High temperature prevailed the first half of the week, which was followed by cooler weather, making an average a little above the normal. The amount of sunshine was below the average. In the larger part of the state showers were frequent, and many localities report excessive rainfall with windstorms of considerable severity, causing some damage to corn and grain in shock and stack. The conditions have been generally unfavorable for securing the unstacked grain, and the aggregate of loss to oats and wheat will be very heavy. The corn crop is so bulky, and generally so well advanced that the local damage by wind and hail will not materially reduce the heavy yield that seems now to be assured. The crop is generally ten to fourteen days early and a large percentage will be practically safe from frost by September 1st. The late planted fields will need four or five weeks favorable weather, to reach full maturity. A good start has been made in fall plowing where the soil is sufficiently dry. There is great need now of a long spell of good old fashioned dry weather, such as we used to have in the pioneer days.

BULLETIN NO. 21, AUGUST 25TH.

The week has been unseasonably cool and cloudy, with an excess of rainfall in the larger part of the state. The weather conditions have not been favorable generally for threshing and for ripening the immature crops. Corn is doing fairly well, however, and, if the coming month is as favorable as usual, the quality of the crop will be better for this extension of the ripening period. If a killing frost does not arrive in advance of its normal time, the crop of 1896 will probably break all former records in the yield per acre, though the area harvested will be less than in some former years. A considerable part of the early planted corn will be practically beyond danger of harm by frost by the 15th of September, if it is not further delayed by cool and wet weather. The late planted fields will need four to five weeks of seasonable warmth, sunshine and dryness to fully mature their immense burden of corn. Pastures are excellent, and the meadows are bringing forth a heavy second crop of grass. The yield of clover seed promises to be large. There are numerous indications of shortage in the late potato yield. Hog cholera is beginning to assume a dangerous form in scattered localities.

BULLETIN NO. 22, SEPTEMBER 1ST.

The past week has been cool and dry, with more than an average amount of sunshine. The daily mean temperature was from 2° to 4° below the seasonal normal. Light frosts occurred in numerous localities on the mornings of the 26th and 27th, but no damage is reported. The weather has been quite favorable for farm work and for maturing the unharvested

crops. Corn is ripening slowly, under the most favorable conditions for its normal development. Reports from all districts indicate that a considerable portion of early planted corn is now practically safe from damage by frost. Probably about 60 per cent of the whole acreage planted will require two or three weeks of good weather to reach complete maturity. Threshing is nearing completion, and plowing has progressed rapidly, with good conditions of soil. A considerable acreage is ready for fall seeding. A heavy second crop of hay is ready to harvest. Pastures are fine, and fall feed will be unusually abundant. The yield of flax is generally good. Reports of the potato crop are quite variable, and the prospect is not favorable for an average yield.

BULLETIN NO. 23, SEPTEMBER 8TH.

The past week was cooler than usual, with about the average amount of sunshine and generally light rainfall. The temperature fell dangerously near the frost line on two mornings, but as yet no damage has been done. Corn has made fair progress toward maturity, under favorable conditions for the full development of the grain. Some cutting in early planted fields has been done, and probably more than 50 per cent is ripe enough to cut. While a considerable acreage is practically safe, yet, if a killing frost comes before the 25th inst., there will be more than the usual amount of soft and immature corn harvested this season. To round out the entire crop, all of September is needed, with normal temperature and sunshine. In the sections where fall grain is grown, good advancement has been made in plowing and seeding, under excellent conditions. Nearly all reports indicate a large output of clover seed. Reports as to the potato crop are quite variable, with frequent mention of damage by rotting. Threshing is nearing completion, and the harvest of prairie hay is in progress, with a fine yield. There are numerous reports of hog cholera.

BULLETIN NO. 24, SEPTEMBER 14TH.

The mean temperature of the past week was about normal, and there was a large excess of cloudiness and damp weather. The rainfall was in excess in scattered localities, but the average for the state was below normal. There were but three favorable days for ripening and drying out the corn, but the general condition is fairly good. Reports indicate that the bulk of the crop is practically safe in the northern districts, wherein it is generally farther advanced toward maturity than in the central and southern districts. Cutting is in progress in all sections, and in the dairy districts a large portion of the crop will be cut and shocked within the coming week.

For the complete ripening of the full crop of corn we need from ten days to two weeks of dry, warm weather. From 20 to 30 per cent was planted later than usual, and much of this is still green and quite immature. The potato harvest is begun, with a variable output. Dry weather is needed for harvesting and hulling clover seed. Fall plowing and seeding are being rapidly pushed. More than the usual area will be plowed, the conditions of the soil being favorable.

SPECIAL BULLETIN, SEPTEMBER 22D.

The past week was unseasonably cold, wet and cloudy. The daily mean temperature was 2° to 4° below normal, and the rainfall was largely in excess in the greater portion of the state.

On the mornings of the 19th and 20th heavy frosts were reported in numerous localities in the northern and central districts, with temperatures low enough to form ice in many places. The extent of damage to corn can not as yet be estimated. It is certain, however, that a considerable portion of late planted corn is yet soft, requiring warm, dry weather to become sound and merchantable. There has been thus far in September but little favorable weather for ripening the belated portion of the crop; and the low temperatures and excessive moisture have been detrimental to both early and late corn. With more favorable conditions in the near future a large yield may be harvested; but it cannot reach the high aggregate that would have been secured if normal weather had prevailed for the past three weeks.

Reports indicate that the potato crop will fall considerably below the large output last year.

SPECIAL BULLETIN, SEPTEMBER 29TH.

The temperature of the past week was about 40° below normal, and the deficiency for September to date amounts to over 100°, with a large excess of cloudiness and moisture.

These unfavorable conditions, with severe frosts, have checked the ripening of belated corn, comprising probably 15 to 20 per cent of the entire acreage. This will somewhat reduce the aggregate of the crop, which a month ago promised to break all former records. But with drying weather in the future the total yield of sound corn will fairly sustain the reputation of the leading corn state.

The late potato crop is not likely to reach an average yield.

Fall pastures are extra good. The growth of grass and vegetation generally has been phenomenal.

WEATHER AND CROP NOTES.

FROM MONTHLY REVIEW, JULY, 1896.

The spring and summer of 1896 will score a high record among the wet seasons of this region. It is the more notable from the fact that it follows so closely a period of excessive dryness. For study and comparison we give below a table showing the average rainfall in inches for this state in the months of April, May, June and July, for the years from 1890 to 1896 inclusive:

YEARS.	APRIL.	MAY.	JUNE.	JULY.	TOTAL.
1890 .....	1.78	3.56	7.76	1.98	15.08
1891 .....	2.15	3.18	5.39	4.22	14.94
1892 .....	4.75	8.77	5.19	5.29	24.00
1893 .....	4.21	3.45	3.91	3.33	14.90
1894 .....	3.07	1.87	2.67	.63	8.24
1895 .....	2.62	3.19	4.32	3.40	13.53
1896 .....	5.02	6.69	3.11	6.90	21.72
Normal.....	2.60	4.15	4.95	4.30	16.00



It will be observed that 1892 and 1896 score the highest records for excess of rainfall during these four critical crop months. The normal or average amount for this state is sixteen inches for the four months, and in the seven years there has been a deficiency in five seasons and an excess in two seasons. And the best average crops have been grown in the seasons when the rainfall was an inch or two below the normal. To show the relation between rainfall and production we give below the average yield per acre of some of the staple cereal crops of this state in the six years, 1890 to 1895, inclusive:

YEARS.	Corn—bushels.	Oats—bushels.	Wheat winter—bushels.	Spring wheat—bushels.	Barley—bushels.
1890 .....	28	29	16	11	24
1891 .....	38	40	20	15	22.5
1892 .....	29	25	17	12	24.3
1893 .....	35	28	15.4	12.4	22.8
1894 .....	12	24	16.7	12.8	18.4
1895 .....	38	48	22	17	33

Since 1890 the greatest crops have been harvested in the seasons of 1891 and 1895. By reference to the first table it will be seen that the rainfall in the four crop months of these years was uniformly moderate, and a little short of the normal. The year 1895 brought the best all-round harvests, because the soil had been thoroughly drained and pulverized by the drouth that prevailed in the summer, fall and winter of the preceding year. And upon this well prepared soil there came moderate showers with sufficient frequency to keep the crops growing at their best. In the greater part of the state the rainfall was ample, though the total was two and one-half inches below the normal. It appears that our best crops are grown in the seasons closely following a drouthy period, or just before the opposite extreme is reached.

The oats crop shows the ups and downs of the seasons, with but two good crops in the seven-year period. The yield was better in respect to quality in the extremely dry season, 1894, than in the excessively wet seasons, 1892 and 1896. Excessive heat and moisture in May and June will always knock out oats. And other small grain crops suffer in hot and wet seasons.

The rainfall for the four months—April 1 to August 1, 1896—amounted to as much as the total precipitation for the full year 1894. It has been excessively wet in both seed time and harvest, making it muddy in sowing and “catchy” in reaping. This is an exceptional experience in this section, our wet springs being usually followed by dry periods in mid-summer. It’s a marvelous change from an average monthly rainfall of about 2 inches in 1894, to 5.50 inches per month in 1896. What does this signify? Shall we adopt the method of reasoning that has been in vogue in recent dry years, and jump to the conclusion that the people have caused a change of climate by doing something they ought not to have done, or leaving undone something they ought to have done? Is it true

that this region is going to be permanently wet? Will it keep on raining, filling up the ponds and streams, making more vapor to make more showers to be again evaporated and precipitated continually? Have we ruined our climate by planting too many groves, hedges and shelter belts, thereby drawing the rain clouds from long distances to drench our fields with excessive downpours? If the work of man caused the drouth in 1894, shall we not infer that the people are in some way responsible for the excess of moisture in the year of grace, 1896?

No, we think the plea of not guilty could be sustained in any court of competent jurisdiction. The people are not to blame either for excessive rains or parching drouths. Don't chop down trees, or clear off sheltering groves, on the mistaken supposition that they bring too much wet weather. That would be as foolish as tearing out tile ditches or damming up creeks to cure drouths. The causes of extremes, or variable seasons, are far above and beyond the reach of human hands. Only the Omnipotent is able to grasp and wield these mighty forces of nature.

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This country is not going wet, except at intervals. In due time the pendulum will swing to the opposite extreme, and the lowlands, lake beds and bottoms of sloughs will dry up and once more become arable. Don't be discouraged with these occasional wet seasons. We shall have good, old fashioned, dry summers in the near future to teach us profitable lessons of economy and the proper cultivation of the soil. They are sure to come about as often in the future as in the past fifty years. Don't worry about any change of climate, but so watch and work, and apply brains to your work, that you may reap abundant rewards for your labors in every season, whether wet or dry. This may be done, and the coming farmer will learn how to do it.

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Many people take pleasure in seeing the ponds filling up, and the streams again running bank full, after the fashion of the pioneer days in this country, before the impervious old prairie sod had been broken. But they do not observe that these swollen streams are swiftly bearing away thousands of tons of the most fertile matter washed from our fields. Take note of the marvelous productiveness of the low lands that are replenished by spring and autumn floods, where the murky waters deposit their rich burden of fertilizing material year by year. All of that cream of the soil has been washed from the surface of uplands and slopes; and over 95 per cent of the richness is carried to the sea and is a total loss to the soils. We take pleasure in seeing well filled streams, but we much prefer to note the flow of clear, sparkling waters. When all the fields are properly tiled the flowage of streams is lessened, and the waters that find their way into the larger streams, and thence to the sea, are not so heavily burdened with the elements of fertility. On all accounts it is better to carry away the surplus waters through deeply laid tiles than over the surface. By deep culture, subsoiling where it is necessary, and thorough deep tile drainage, we may conserve all the water that can be retained, and get rid of excess with the least damage to our fields.



## VALUE OF WEATHER OBSERVATIONS.

Prof. Lorin Blodget, of Philadelphia, recently contributed the following article to the Monthly Bulletin of the Pennsylvania Climate and Crop Service:

"The practical value of climatological observations is now as clear and definite as any branch of the public service whatever, and it cannot be suspended at any time without serious loss. The business interests of every part of the state have come to the point of adapting themselves to the current daily reports of changes, the forecasts made by the National Weather Service, and the comparison of the fixed conditions of climate, determined chiefly by the state services; and this well-earned position of influence and character of authority attached to both departments of the weather service cannot be dropped nor permitted to fail in the current and continued work each has in charge. The state has a duty, as well as the general government, and the body of faithful observers who have furnished records for so many years should be sustained and rewarded to the fullest possible extent.

"It is now almost half a century since the general service of reporting observations of the climate began. It was done earlier by order of the surgeon-general at the military posts and the New York academy, while in this state—Pennsylvania—the Franklin Institute invited co-operation in recording the temperature, rainfall, etc., as early as 1839. From 1848 to 1858, the Smithsonian Institution, at Washington, made extensive preparations for a national system of observations, which, however, produced little in practical results and was practically abandoned in 1858. In 1871, General Myer began the present system of storm and weather reporting. He founded the Weather Bureau, and the singular vigor and practical accuracy of his work attained universal approval, securing from congress full recognition as a permanent executive bureau in the public service. In recent years this branch of the national service has developed greater skill and accuracy than was believed possible, especially in the forecasting and in the forms employed in current illustrations. The public feels its daily value and is conscious of its absolute need of the service rendered.

The several state systems hold a position in respect to the national system much as the state governments do to the general government. They are indispensable as aids and adjuncts to each other, and the state work covers a wide field that the national bureau cannot reach. Each county and each district should be examined and its climate defined. Its productive capacity as to cultivation, its forest growth, its healthfulness, and all other conditions, should be defined by instrumental record and by the establishment of both the mean and the extreme conditions. And, in respect to the range of these extremes, it is certain that continuous records must be made, and that no definitions as to one season or year

will practically apply to the next season or year. The sources from which the very atmosphere comes in its annual movement are as remote, practically, as is the sun as the source of atmospheric heat.

"We have a duty of the broadest and most practical character in thus observing and determining the climate of the state in all its conditions. It is a duty scarcely less imperative than that of providing for the well being of its inhabitants through the ordinary functions of its state government. The work of the service is not speculative nor theoretical as to any of its conditions. Its duty, primarily, is to make permanent records of the facts, and this for as many localities as may be possible, or may be required, to define the climate of every habitable area within the state limits. The difference due to elevation, as well as those of geographical position in other respects, are among the points that should be better known than they now are.

"The sweep of the greater changes and storms that pass over the entire country can better be shown in the work of the national bureau, but there is a share of duty, even in this respect, falling to the hands of the state."

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## DISTINGUISHING A TORNADO.

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HARPERS' WEEKLY.

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Perhaps the most important distinction to emphasize is that between the appearance of a thunderstorm and a tornado, since, if this can be defined, much needless fear at the approach of black but harmless thunderstorms can be avoided. When not combined with tornado manifestations the thunderstorms send aloft a narrow line of black clouds in advance, which remain high in the air. At the right and left the black clouds seem to reach the earth, but this is caused not by descent to the earth, as in a tornado, but by distant edges of the high black clouds receding below the horizon. It is one storm which spreads to the left and right. There is no splitting up of clouds with the formation of a different storm at another part of the horizon.

The tornado is easily distinguished from this perfectly plain edge of black, with its lighter rain mist extending to the earth. Whether the funnel is veiled by rain or not it is ordinarily so black that as it approaches it appears as a column of dense darkness, narrowest at the earth, with light breaking through on either side of it. The most marked trait of all is that other clouds seem to be approaching, others moving at right angles, and a distant storm of light hue is coming from the southwest. This is all caused by the tornado, which is drawing clouds and air currents toward itself from great distances. As the tornado funnel comes nearer, with its dark mass of rubbish reaching to the earth, the roar is frightful, giving the observer fifteen or twenty minutes' warning. The southwest corner of the cellar, if the tornado is approaching from the south or west, is the safest place of refuge. The tornado carries the wreckage to the north and east, and if the funnel is seen in the north or east it need not

be feared, because it will almost certainly move away. Of 600 tornadoes specially classified, all but thirty-five moved from southwest to northeast, and nearly all of the thirty-five moved eastwardly.

The funnels have a rotary motion from right to left, and this motion is not due to electrical action, but to acceleration of conflicting air currents. Lieutenant Finley shows that the lightning supposed to be in the funnel is really in adjacent thunder clouds. The broken and withered buds bruised by the action of the air are evaporated by the sun after the tornado, causing the foliage to look seared, giving rise to the error that the tornado manifests burning electrical power. It has been demonstrated by study of wreckage that as the funnel leaves the earth and rises into the air its force slightly diminishes, and that this bounding motion causes the funnel to spare one building and demolish another. The funnel, with its small end to the earth, spins like a top, moving along at an average rate of about forty miles an hour, but the velocity of the spin is incalculable. It is like the motion of air impelled by an explosion.

Tornadoes generally occur between 1 P. M. and 5 P. M., and not one in a thousand takes place between 10 P. M. and noon of the following day. I have heard of only two instances in which the tornado occurred between midnight and morning—one at Hohokus, N. J., and another in the southern part of Michigan, which caused slight loss of life. Since these are only two in about 2,000 cases, the danger from tornadoes at night is so small that it need not be considered.

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### COLD WAVES IN FORMER YEARS.

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Some of the old-time weather records do not appear to sustain the current notion that the work of man on this continent, in the cultivation and drainage of the soil and clearing away portions of the primeval forests, has developed a tendency toward climatic extremes in form of floods, drouths, cold waves, hot winds, etc.

The winter of 1894-5 was unusually severe in the Gulf states. Zero temperatures were recorded in northern Alabama and Georgia, and killing frosts reached the Gulf, resulting in the wholesale destruction of orange orchards far to the southward in the Florida peninsula. This was said to be an unprecedented incursion of the cold waves and winter blizzards into that favorite paradise of northern tourists, and some writers gravely assured us that the extreme effects were produced by clearing away some of the timber in the northern sections of the Gulf states.

The old-time weather records, however, show that severe cold waves and killing frosts occasionally visited that region in the first half of the present century, before the forests had been disturbed. In the *Climatology of Alabama*, by Prof. P. H. Mell, we find the following notes compiled from the reports of the Smithsonian Institution and other reliable weather records:

"1832. A winter of great severity. At Huntsville, Ala., the thermometer registered 9° below zero."

"1834-5. These were both cold winters. February 6 and 7, 1835, were exceedingly cold, the temperature being  $6^{\circ}$  at sunrise."

"1852. Thermometer registered  $8^{\circ}$  at Mobile, January 20th. The spring was cool, inclement and late."

"1855-6. The winter was the coldest since 1852. Standing water near Mobile was frozen hard enough to permit of skating—a most unusual sight for that latitude."

In 1877 the Bigbee river was frozen over in January. In the winter of 1884-5 the frozen condition of the ground hindered farm work in Alabama. In December, 1886, the temperature in northern Alabama fell to  $6^{\circ}$  below zero. Snow covered the northern counties to the depth of 20 inches, and 12 inches fell in the southern part of the state. In the January following the cold was severe enough to kill cattle that were not sheltered.

These records indicate that the tendency to extremes in temperature is not of recent origin. Northern Alabama, it should be noted, is quite heavily timbered; yet the cold waves are tall enough to climb over the tallest trees in that region. In matter of fact, cold waves tumble downward from the crests of advancing "highs." It would require a mighty big wall of hills and trees to shut them out.

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The New York Sun recently published some interesting reminiscences of old-time winters and sudden onslaughts of cold waves, related by an octogenian, who was one of the pioneer settlers in Illinois. The old gentleman said:

"I was an Illinois pioneer. My folks settled in a piece of timber in McLean county, known as Keg Grove. The city of Bloomington occupies the site of Keg Grove now. We settled there in 1829. There were only 40,000 people in the whole state of Illinois then. Neighbors were few and far between about Keg Grove.

"The fall and early winter of 1830 were very dry and mild. Late in December, and with very little warning, snow began falling. It didn't fall, either; it tumbled. It came down in regular ready-made snow-banks, and continued, without a moment's let-up, for two days and nights. You may have some idea of how deep the snow fell when I tell you that when it went away in the spring the stumps of trees that had been cut for firewood, as the choppers stood on the snow during the winter, were seven feet high, that being as low down as the choppers could get at the trees. In going to a neighbor's I drove over the tops of their orchard trees and did not know it. It was a fortunate thing that the corn crop had been good that year, for so many families were so blockaded by the snow that they could not get out of their houses. They would have starved to death, but they lived on corn, which they pounded into coarse meal or hominy, and that was so generally the case that the winter was ever afterward known to the pioneers as the hominy winter.

"There was heavy frost every month in the year after that deep snow. Corn couldn't ripen, and there wasn't enough gathered for seed to plant the next season. There wasn't a bushel of seed corn to be had nearer than Ohio in 1832. It cost \$3 a bushel. John Duffy came in that year with a few bushels of small, yellow corn from Pennsylvania. That was planted. It was matured early, and some people out there raise Duffy corn yet.

"But in December, 1836, the prairie pioneers got some weather that made them quit dating things from the winter of the deep snow. The month had been warm and moist. Everything was slush and slop and mud. Suddenly the wind began to blow a gale. It came out of the northwest, and no wind that ever swept over those prairies, before or since, came so near being a blast from the north pole as that one was. Almost instantly the mercury dropped from  $40^{\circ}$  above to  $20^{\circ}$  below zero, and the falling rain was turned at once to pellets and barbs of ice. The damp air froze so quickly that it became one great cloud of flying frost.

"This polar blast swept down upon us at 3 o'clock in the afternoon. John Dawson was on his way from Williams' mill, six miles down Salt creek. He had gone half a mile from the mill when he heard a roar like thunder. The noise was behind him. Looking around, he saw the storm coming and the rain freezing before it. When it struck him, he turned to go back to the mill. The slush had been more than fetlock deep. By the time Dawson had urged his horse around a hundred yards, the slush was frozen so it bore the horse's weight, and it was with great difficulty that Dawson got back to the mill, the water in the road having become such a glare of ice that his horse could scarcely make his way over it.

"Fowls that were out on soft ground while this unheard-of change of weather came were frozen fast where they stood. Cows froze in their tracks. Our folks had three hogs frozen to death while they were hurrying from their feeding-places to their pen, less than 300 yards away.

"That cold snap lasted six weeks, and was a spell of weather that made folks shudder whenever they thought of it, even in summer-time, for many a year afterward."

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#### WEATHER MAPS—HIGHS AND LOWS.

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In the *National Monthly Weather Review* Prof. A. Cleveland Abbe explains the meaning of some of the lines and terms on the daily weather maps. He says:

"The words 'high' and 'low' are used as contractions for 'high pressure' and 'low pressure.' Inasmuch as atmospheric pressure is measured by the barometer, these expressions are also equivalent to saying that the column of mercury in the barometer is a tall one or a short one. If a syphon barometer is used, the top of the long column is above the top of the short column by a larger or smaller amount; the difference in height between the tops of the long and short column is usually more than 30 inches when the pressure is high and less than 30 inches when the pressure is low and when the station is near sea level. If an aneroid barometer is used, the index or pointer usually turns toward the right hand for higher pressures and toward the left hand for lower pressures.

"The map shows, by means of isobaric-lines, the regions where the pressure is the same. Some of these isobars inclose a region of high pressure and others a region of low pressure. High areas are the regions of high barometric pressure. With the high areas we usually associate cool or cold, dry, clear weather and gentle winds. With the low areas we usually expect warmer, moist, cloudy, and rainy weather and strong

winds, and sometimes also thunderstorms, tornadoes and hailstorms. Therefore the low areas are sometimes spoken of as storm centers.

“ The term barometric pressure or simply barometric readings is often used without realizing its meaning in meteorology. Ordinarily we appreciate the temperature of the air by our personal sensations so clearly that when we see a record of 100° F., we instinctively think of the heat and the temperature, and the most ordinary meteorological observer doubtless sees in his mind's eye the relative levity or buoyancy of the air, due to the fact that it is expanded by high temperature. But our nervous organization is not generally sensitive to the ordinary changes of atmospheric pressure; we have not a mechanical sense to tell us of the pressure or push of the ordinary air. Occasionally one will be found whose ears ring when the atmospheric pressure is high or whose nerves pain him when the pressure is low. To the meteorologist, however, the expression high or low pressure conveys an idea of force exerted in compressing the atmosphere and of expansive force within every cubic inch by which it tries to enlarge its boundary. To him a high barometer means that the air is being condensed by pressure, and *vice versa* a low barometer that the air is expanding by reason of the relief of pressure. The pressure ordinarily exerted by the atmosphere is about 15 pounds to the square inch. This pressure would balance the weight of a column of mercury 1 inch square and 30 inches high. This is the pressure that is holding every cubic inch of our lower atmosphere within its bounds; if the pressure relaxes the cubic inch of air expands. If, for instance, the weather map shows that a region of low pressure is advancing upon any station, the observer may expect to find the air within any confined space pushed outward through every possible aperture; the air in the soil comes up; that within a cavern pushes out through the entrance; bubbles of air in liquid expand in size; hermetically sealed cans bulge outward. These and similar phenomena show the observer that the pressure of the atmosphere upon all bodies at the surface of the earth has diminished and that internal pressures that before were counterbalanced by the atmospheric pressure now have the preponderance. The force that pushes the air forward when the wind blows is this atmospheric pressure of about 15 pounds to the square inch, or rather it is the difference in atmospheric pressure, since the full pressure of 15 pounds to the square inch could only come into play when the air or wind is blowing into an absolute vacuum.

“ The motion of the wind is the result of pressure from behind just as truly as is the motion of the piston rod of a locomotive engine. The piston usually has the atmospheric pressure of 15 pounds to the square inch on one side of it and the steam pressure of 100 or 200 pounds to the square inch on the other side, and this great difference of pressure is necessary in order that so small a piston can do so much work. The pressure and the action of the steam engine piston are intense. On the other hand, in the atmosphere a small portion of air moving along as a rapid wind has a very little excess of pressure in the rear over that in front. A vertical sheet of air one foot thick moving forward as the front of a violent gust may, for instance, have a pressure of 29.50 inches in front and 29.51 inches in the rear; this difference of .01 of an inch is about 1-2950 of the whole pressure; or about .005 pounds per square inch, or .72 pounds per square foot. Now,



a cubic foot of air weighs about .07 of a pound; and as the above force is continuously pushing this mass, it soon gives it a great velocity, and maintains it at that velocity by continuously overcoming friction and other resistances. The atmospheric pressure pushing from all sides toward a region of low pressure soon sets the air into a whirling motion; it may be on a very small scale, forming a waterspout or a tornado that would scarcely make any show on our daily weather map, or it may be in great whirls, such as constitute hurricanes or other cyclonic storms."

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### ATMOSPHERIC WAVES.

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It is rather startling to be told on high scientific authority that we are living most of the time, submerged in waves to which the greatest waves of the ocean are mere ripples in point of size. This a suggestion or discovery of the late Professor Hemholtz, of Berlin, and the enormous waves are waves of air.

When a current of air blows across a water surface, water waves are produced, and when a current of air blows across a surface of quiet air, or air having a different motion from the first current, then air waves will be produced.

These atmospheric waves, Professor Hemholtz showed, have all of the phenomena of water waves—troughs, crests, foaming, breaking and spraying. But since the qualities of air and water are so different, the air waves have dimensions over 2,500 times those of the corresponding water waves.

Thus the great ocean waves of perhaps twenty-five feet in height would have atmospheric counterparts extending upward a distance of ten or twelve miles above the earth's surface. The passage of the huge air waves would be felt by us, since they would cause a stirring up of the air at the earth's surface somewhat similar to that produced by the passage of water waves over shoal places.

The undulating movement of such air waves would account in part for the intermittent gusts of wind which we notice so frequently in storms.

The presence of these waves is also indicated by the existence of certain kinds of regularly formed cloud groups, in which each cloud marks the crest of an air wave.

This meteorological conception of the great German scientist opens up to observers a very interesting field, and the mere statement of his theory enhances the interest with which we all gaze into this thin medium wherein we live and move and have our being.—*F. Waldo.*

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The general causes which act on the movement of the atmosphere are defined by Professor Cornu, in an address lately delivered before the British Royal institute, as gyratory influences, and, when once the movement is set going, it continues of itself and sometimes increases in amount. In the first place, Professor Cornu declares, the movement of the rotation of

the earth is to be cited, which always brings with it a small component of rotation for a displacement of a gaseous mass in latitude or altitude, and, in the second place, and as decisive a cause, the solar heat, which warms the air near the surface, or the clouds. Thus related, and as the ascending tendency of the heated gas cannot be equal over the whole surface exposed to the rays of the sun—as much because of the nature of the ground as because of its inequalities—the equilibrium is upset in parts and gaseous columns ascend. When once gyration is established, the causes producing it keep it up and augment it.

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### CLAYTON COUNTY RAINFALL RECORDS—46 YEARS.

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(From records kept by Hon. Maturin L. Fisher and Frank Larrabee.)



# ANNUAL REPORT OF THE RAINFALL RECORD AT ONAWA, IOWA.

BY C. G. PERKINS, OBSERVER.

## PRECIPITATION DATA.

Average Monthly and Annual Precipitation (rain and melted snow) at various Iowa stations for the period of years named in the last column.

STATIONS.	January.	February	March.	April.	May.	June.	July	August.	September.	October	November.	December.	Annual	No of years.
Albia	.91	1.89	2.17	2.04	4.18	5.11	4.54	3.03	4.40	2.07	1.84	1.16	34.45	11
Algona	.82	1.57	1.53	2.22	3.48	4.62	3.04	3.62	3.23	2.21	1.30	.99	37.77	14
Ames	1.42	1.30	1.90	2.32	4.24	4.07	4.16	3.56	3.94	2.84	1.82	1.48	33.67	21
Ames	1.06	.78	1.40	2.77	4.09	4.47	4.72	3.50	3.54	2.24	1.27	1.02	30.44	12
Brookside	1.43	1.67	2.43	2.90	4.82	5.76	5.97	3.29	4.80	2.62	2.24	1.36	40.97	10
Brookville	1.26	1.23	1.99	3.00	4.83	4.97	2.82	3.39	3.00	2.95	1.77	1.62	32.24	11
Cedar Rapids	1.82	1.60	2.37	3.02	4.71	3.84	3.85	2.96	2.87	2.76	1.61	1.75	32.57	13
Cresco	1.34	1.00	1.77	2.16	3.47	5.14	4.31	3.13	3.94	2.36	1.50	1.42	31.45	19
Council Bluffs	.80	1.18	1.37	2.54	4.59	5.93	5.23	3.34	3.45	3.04	1.10	.99	33.36	12
Clinton	1.92	2.32	3.27	3.12	4.47	4.63	4.12	2.63	3.23	2.56	1.96	2.11	37.43	17
Davenport	1.64	1.54	2.11	2.80	4.31	4.30	4.73	3.57	3.21	2.54	2.01	1.31	33.39	25
Denmark	1.46	1.98	2.32	2.53	4.47	5.85	3.83	3.52	2.80	3.62	1.87	1.94	35.56	12
Des Moines	1.40	1.31	1.45	2.16	4.62	5.87	3.19	3.51	3.40	3.53	1.90	1.43	35.06	13
Dubuque	1.64	1.48	2.21	3.06	4.15	5.11	4.43	3.11	4.19	2.70	2.09	1.80	34.58	23
Dysart	1.24	1.24	1.73	2.11	3.89	4.97	4.76	3.60	4.75	3.13	1.78	1.65	34.30	11
Elkader	1.58	1.10	1.74	2.91	3.82	8.94	4.25	2.97	3.90	2.72	1.75	2.32	33.26	15
Fairfield	1.46	1.44	2.01	2.93	6.50	4.17	3.20	3.96	3.65	2.82	2.07	1.80	35.21	9
Ft. Madison	1.50	2.08	2.77	3.13	4.30	4.47	3.40	3.68	3.69	2.88	2.20	1.94	37.58	37
Garnaville	1.03	1.11	1.28	2.00	3.75	3.72	5.27	3.29	4.55	3.21	1.08	1.06	30.65	10
Glenwood	.84	.79	1.30	1.49	5.36	4.69	3.78	3.64	2.20	2.43	1.00	.77	30.80	6
Guttenburg	1.14	1.17	1.88	2.33	3.55	5.17	4.62	3.62	3.87	2.31	2.01	1.79	34.16	10
Ida Grove	.82	1.00	.84	1.64	3.85	5.14	3.71	3.14	3.81	2.70	1.00	.94	28.62	17
Independence	1.37	1.03	1.79	2.21	4.17	5.03	4.72	3.43	4.70	2.37	1.52	1.48	33.87	23
Iowa City	1.74	1.55	2.58	3.13	4.21	5.03	4.35	4.67	4.24	3.11	2.64	1.74	38.77	23
Keokuk	1.73	1.40	2.16	2.90	4.01	4.92	4.19	3.12	3.53	3.15	2.03	1.96	36.87	20
LeClaire	1.58	1.99	2.21	2.74	4.94	5.22	4.09	3.26	3.26	3.49	1.71	1.75	35.20	8

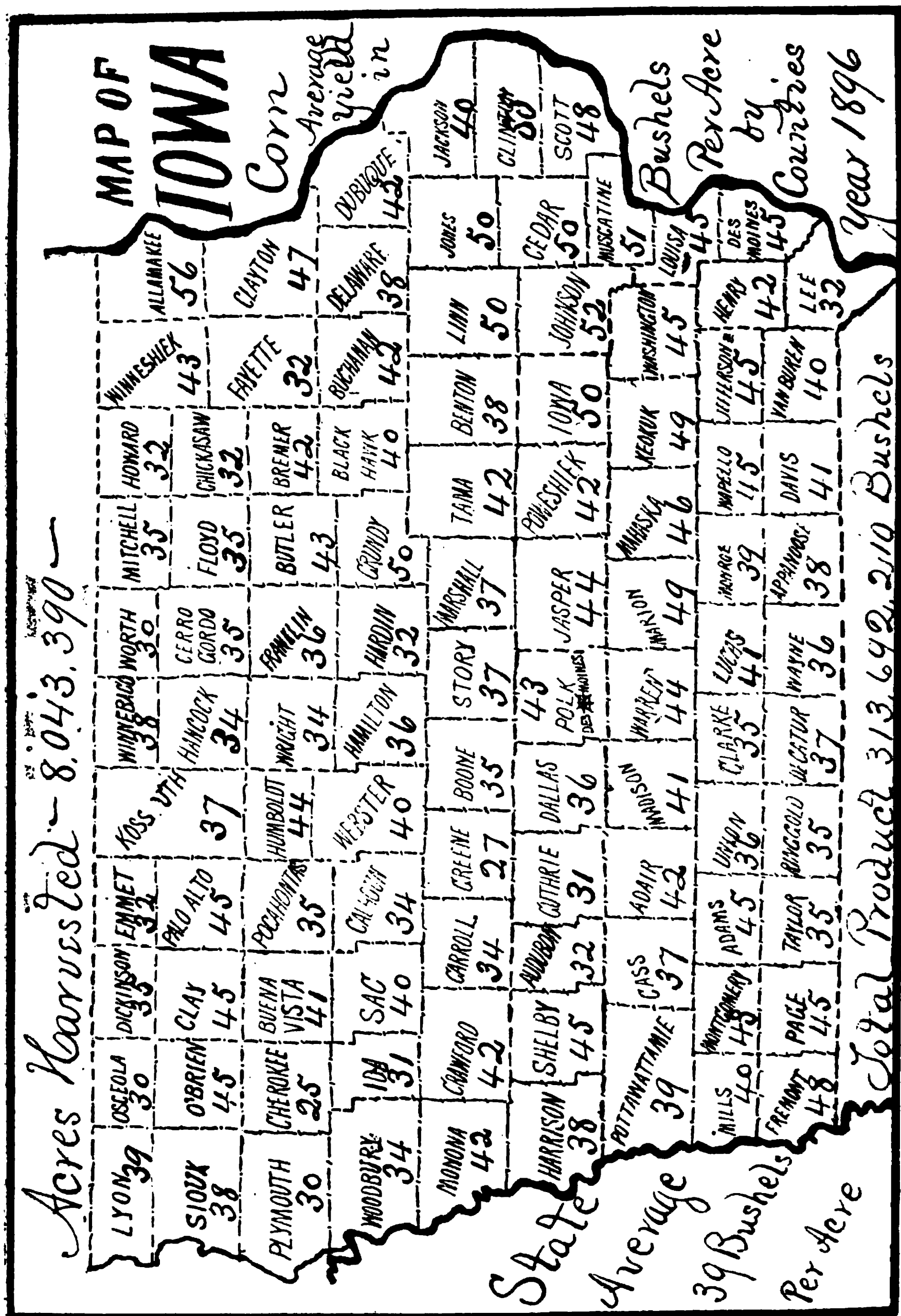
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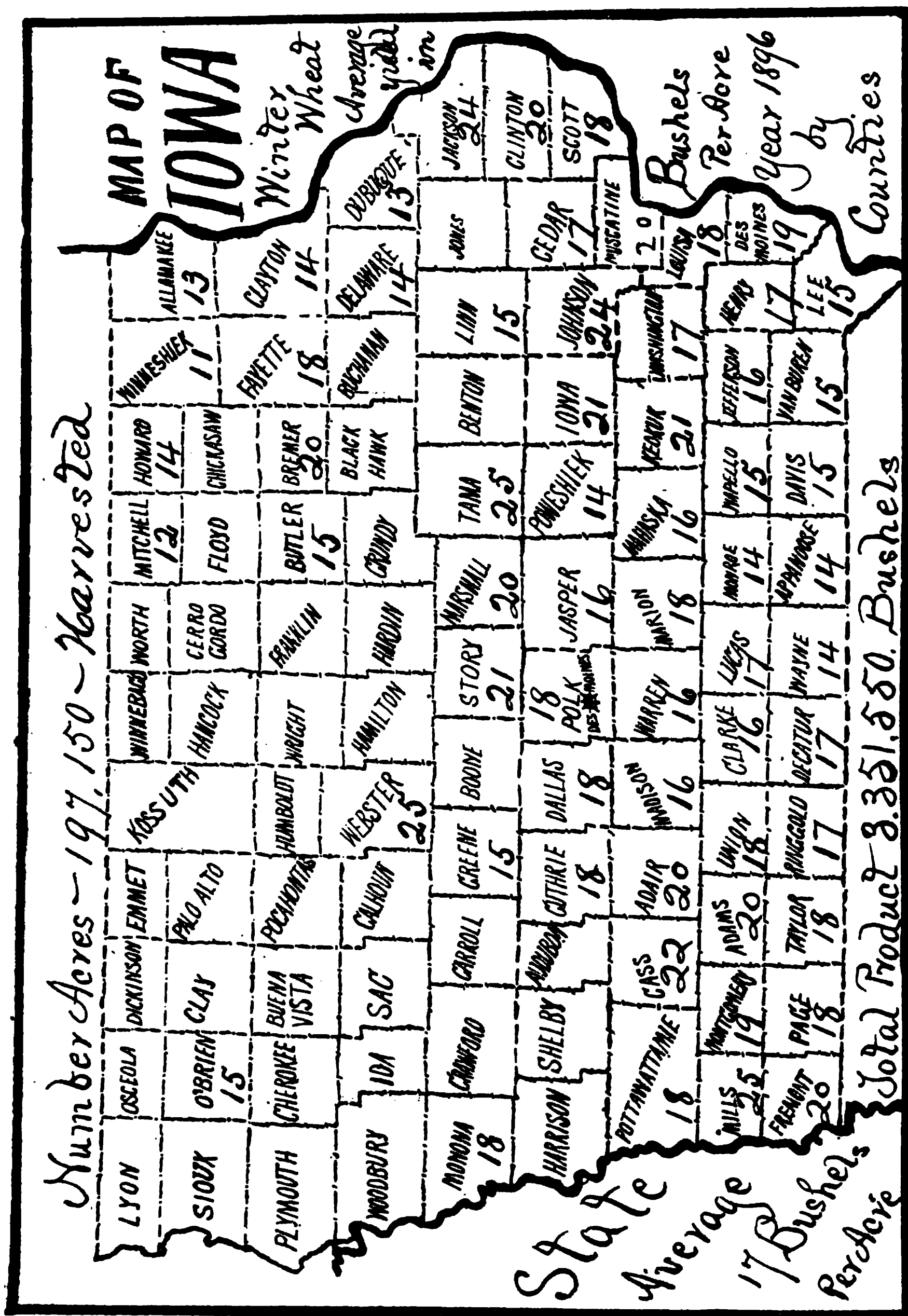
STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.	No. of years.
Logan .....	1.30	1.36	2.06	2.63	4.46	5.84	5.41	3.82	3.33	2.61	1.31	1.35	35.51	16
McGregor .....	1.59	1.21	1.90	2.33	3.68	4.96	5.08	3.37	4.04	3.18	1.78	1.79	34.97	16
Monticello .....	1.57	1.75	2.37	2.62	3.91	4.47	4.20	3.69	3.82	2.77	2.30	2.25	35.79	43
Muscatine .....	1.81	2.08	2.79	3.41	4.38	4.66	3.91	4.38	3.72	3.04	2.30	2.28	39.22	43
Nashua .....	1.54	2.23	2.76	2.07	4.19	5.35	6.68	3.87	5.81	3.45	2.34	3.94	45.16	10
Newton .....	.65	.93	1.27	3.37	4.72	4.13	3.50	3.70	3.32	2.60	2.00	1.26	31.57	9
Osage .....	.88	1.04	1.28	2.26	4.40	4.21	3.56	2.81	3.58	2.62	1.50	1.40	30.14	9
Omaha .....	.67	.73	1.46	3.11	4.51	5.64	5.15	3.42	3.36	2.77	1.23	1.01	33.06	19
Oskaloosa .....	.94	1.13	2.16	2.74	3.62	4.42	3.58	2.93	3.27	2.34	1.89	1.28	31.21	11
Sac City .....	1.29	1.13	1.56	2.91	4.36	5.38	4.11	3.37	3.46	2.28	1.27	1.28	30.83	19
Smithland .....	.54	.65	.63	2.09	3.50	4.32	2.96	2.77	2.84	1.76	1.71	.63	24.43	9
Waterloo .....	1.18	1.24	1.49	2.00	3.38	3.66	4.05	3.71	4.51	2.27	1.40	1.40	30.76	12
Waukon .....	1.50	1.39	2.21	2.34	3.57	4.83	4.90	3.43	4.41	2.27	1.77	1.74	35.20	13
Wesley .....	1.14	1.03	1.42	2.30	3.30	4.74	3.50	2.79	3.52	2.17	1.13	2.16	29.60	10
Means .....	1.05	1.35	1.88	2.60	4.18	4.59	4.22	3.25	3.44	2.78	1.72	1.31	33.50	...

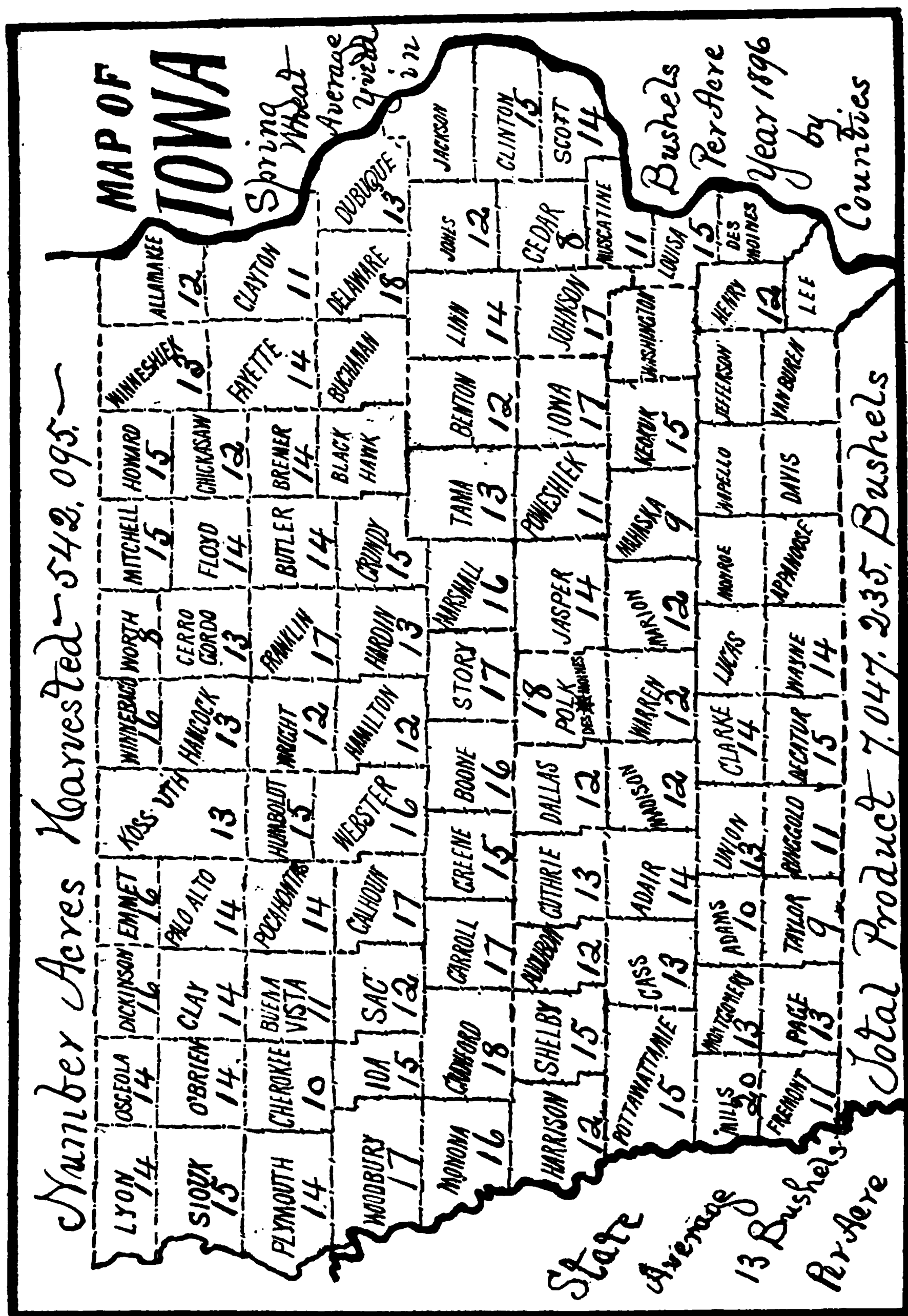
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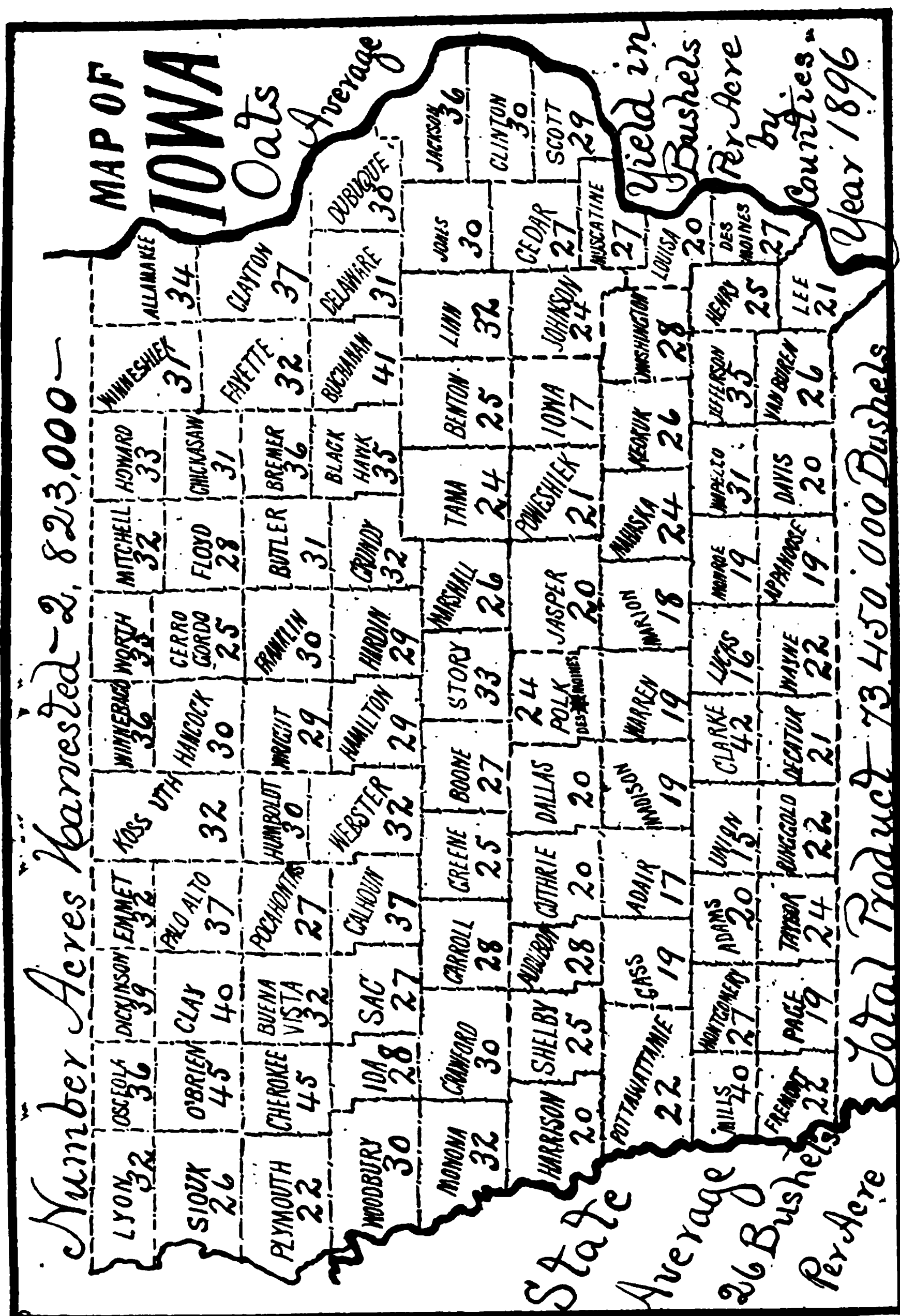
Mean Monthly and Annual Temperature at various Iowa stations, for the number of years named in the last column.

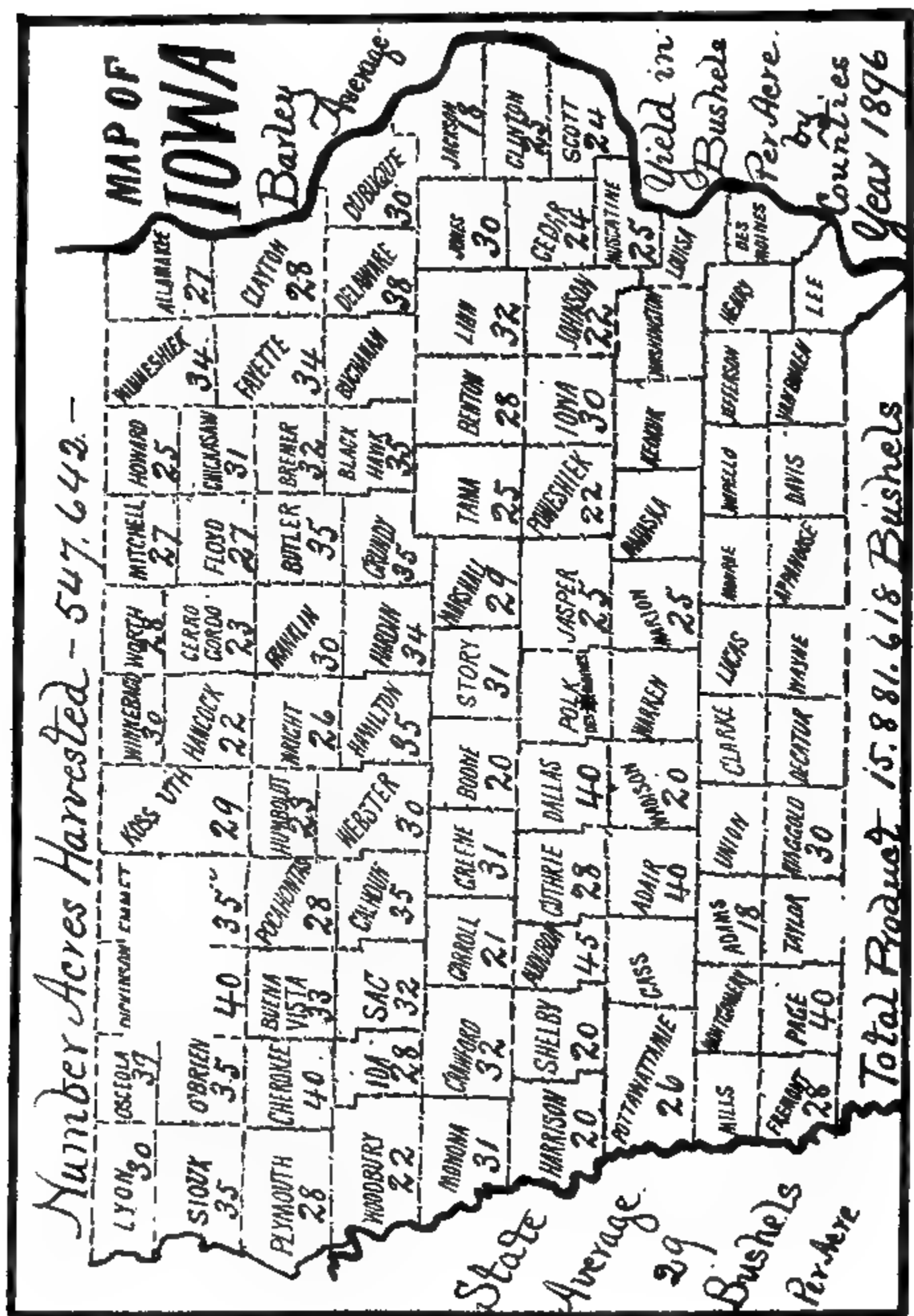
STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.	No. of years.
Albion .....	11.6	17.3	28.7	45.3	59.4	66.9	70.9	69.9	59.5	49.1	29.7	17.1	43.8	6
Algona .....	10.7	17.3	25.5	43.6	59.3	67.7	73.3	70.2	52.9	46.8	31.1	17.8	43.8	11
Amana .....	13.8	20.5	30.7	48.4	59.6	69.5	73.6	70.3	61.4	50.7	31.8	23.1	45.9	19
Ames .....	15.3	22.2	32.0	49.2	58.9	69.9	75.0	72.2	63.0	49.7	31.3	23.7	47.2	10
Brookside .....	12.7	19.9	29.1	45.1	59.0	68.6	73.4	69.9	61.0	48.6	31.4	17.5	44.2	9
Cedar Rapids .....	16.3	21.5	32.4	43.3	59.0	70.6	74.5	71.6	62.6	49.4	34.5	25.6	47.5	14
Cresco .....	9.8	15.4	26.0	43.9	58.4	66.1	70.8	68.6	58.9	45.8	29.2	18.4	42.5	19
Clinton .....	19.1	22.7	32.2	47.8	59.5	69.2	73.4	70.6	62.5	49.3	35.2	25.0	47.0	20
Davenport .....	20.7	25.4	34.8	50.1	61.0	70.8	75.0	72.7	64.5	52.1	38.8	28.0	49.3	25
Des Moines .....	17.9	23.6	34.2	50.6	60.6	69.9	74.4	72.1	63.6	52.0	38.9	26.5	48.3	18
Dubuque .....	18.3	22.8	32.9	49.0	60.4	69.5	74.4	71.7	63.2	50.9	35.1	26.1	48.0	23
Elkader .....	12.5	18.0	30.6	48.3	60.8	69.5	73.7	70.3	61.6	47.8	31.2	22.2	45.5	14
Fairfield .....	13.9	21.8	32.8	49.4	59.0	70.0	74.8	70.1	62.9	50.7	35.0	25.6	47.2	9
Ft. Madison .....	22.4	27.5	37.1	51.2	63.0	73.1	77.6	74.5	65.7	52.7	38.2	26.9	50.8	39
Garnaville .....	9.0	15.3	26.4	43.4	56.8	65.4	69.1	66.6	58.2	46.1	28.9	16.6	41.8	7
Glenwood .....	17.4	23.4	33.0	48.8	59.9	70.4	73.5	72.0	61.7	48.9	33.7	25.1	46.5	20
Guttenburg .....	13.9	20.0	28.7	44.6	57.8	66.7	70.6	67.9	59.5	47.1	31.9	19.3	44.0	17
Ida Grove .....	19.1	25.0	39.6	57.5	70.2	78.4	81.0	82.3	71.8	62.0	41.6	26.2	54.6	7
Independence .....	14.7	21.8	29.9	47.2	59.7	69.1	73.4	70.2	61.3	48.2	33.2	21.7	45.7	24
Iowa City .....	18.9	23.9	33.3	49.1	60.1	68.8	74.1	71.3	63.0	50.3	35.3	27.6	47.6	31
Keokuk .....	23.6	29.1	37.2	51.9	62.8	72.1	77.1	74.4	65.1	54.1	40.0	29.8	49.0	20
Logan .....	18.0	24.8	34.3	49.2	61.0	69.5	74.8	72.5	62.7	51.8	35.6	24.5	48.3	23
Monticello .....	15.2	21.3	31.8	48.3	59.5	68.7	72.9	70.0	61.5	48.7	33.2	22.8	45.9	42
Mt. Vernon .....	17.1	21.8	31.5	48.7	60.5	70.4	74.1	71.2	62.0	49.1	33.8	23.1	46.4	12
Nashua .....	8.5	15.4	26.0	41.8	54.9	64.7	70.6	66.5	57.1	48.2	30.6	18.1	41.8	7
Newton .....	15.4	21.2	31.0	48.4	60.7	70.3	74.7	71.8	61.6	49.6	32.6	23.7	46.6	9
Osage .....	11.6	16.6	26.5	45.3	56.1	66.4	69.4	66.4	58.6	43.6	28.3	21.1	42.2	6
Omaha .....	18.8	25.6	35.4	50.5	62.3	71.4	76.3	74.0	63.9	52.7	36.4	25.4	49.4	18
Oskaloosa .....	16.1	21.5	33.6	49.4	59.3	69.6	75.0	70.9	63.6	50.5	35.9	26.5	47.9	9
Smithland .....	14.4	17.0	28.5	44.5	63.1	67.9	70.7	70.9	58.8	49.5	26.9	16.4	43.9	4
Washington .....	16.8	23.7	32.2	50.9	61.1	72.5	77.9	73.6	63.8	51.0	35.4	25.1	49.0	10
Wesley .....	15.1	22.2	34.4	54.7	60.3	74.7	77.6	75.7	66.4	54.2	35.8	22.8	49.5	8
Means .....	15.6	21.4	31.7	48.1	60.0	69.6	74.0	71.3	62.2	50.0	33.6	23.0	46.6	...



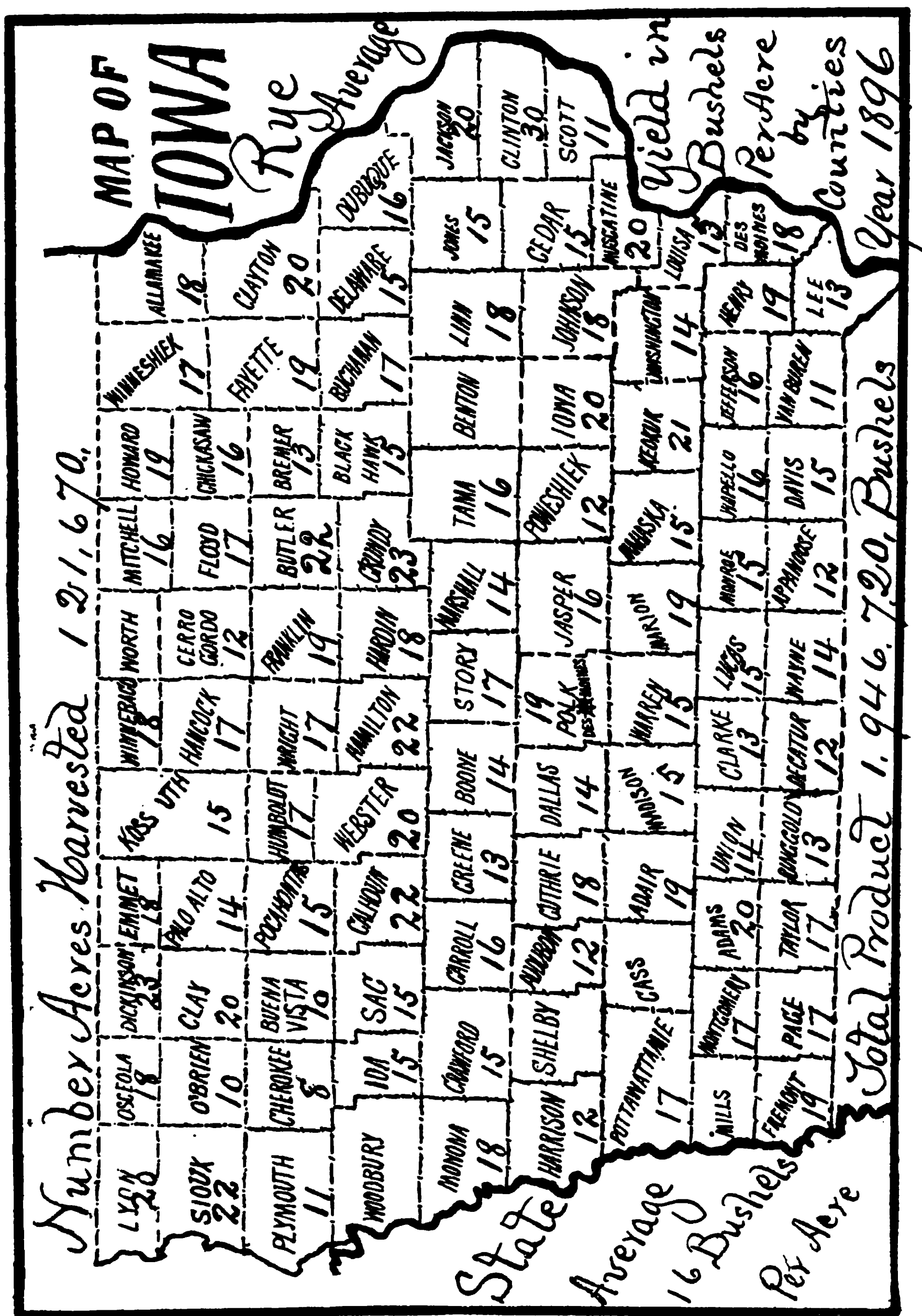






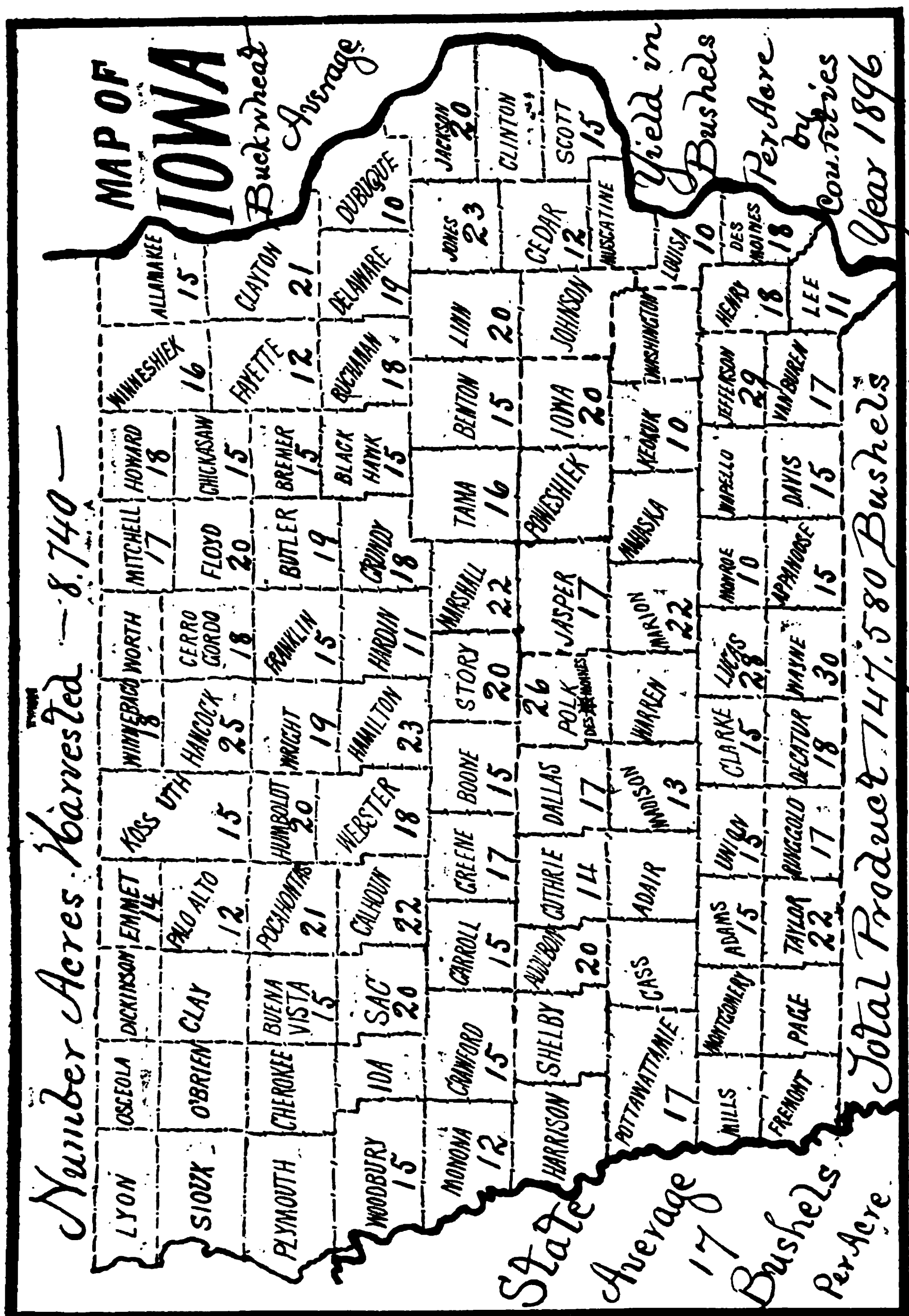












TEM ATU	
Mean.	
49.8	7
46.8	7
46.5	7
47.4	7
46.8	7
47.8	7
46.8	7
54.2	7
44.6	7
50.9	7
46.4	7
47.4	7
47.8	7
49.8	7

5 5 5 2

## OCTOBER.

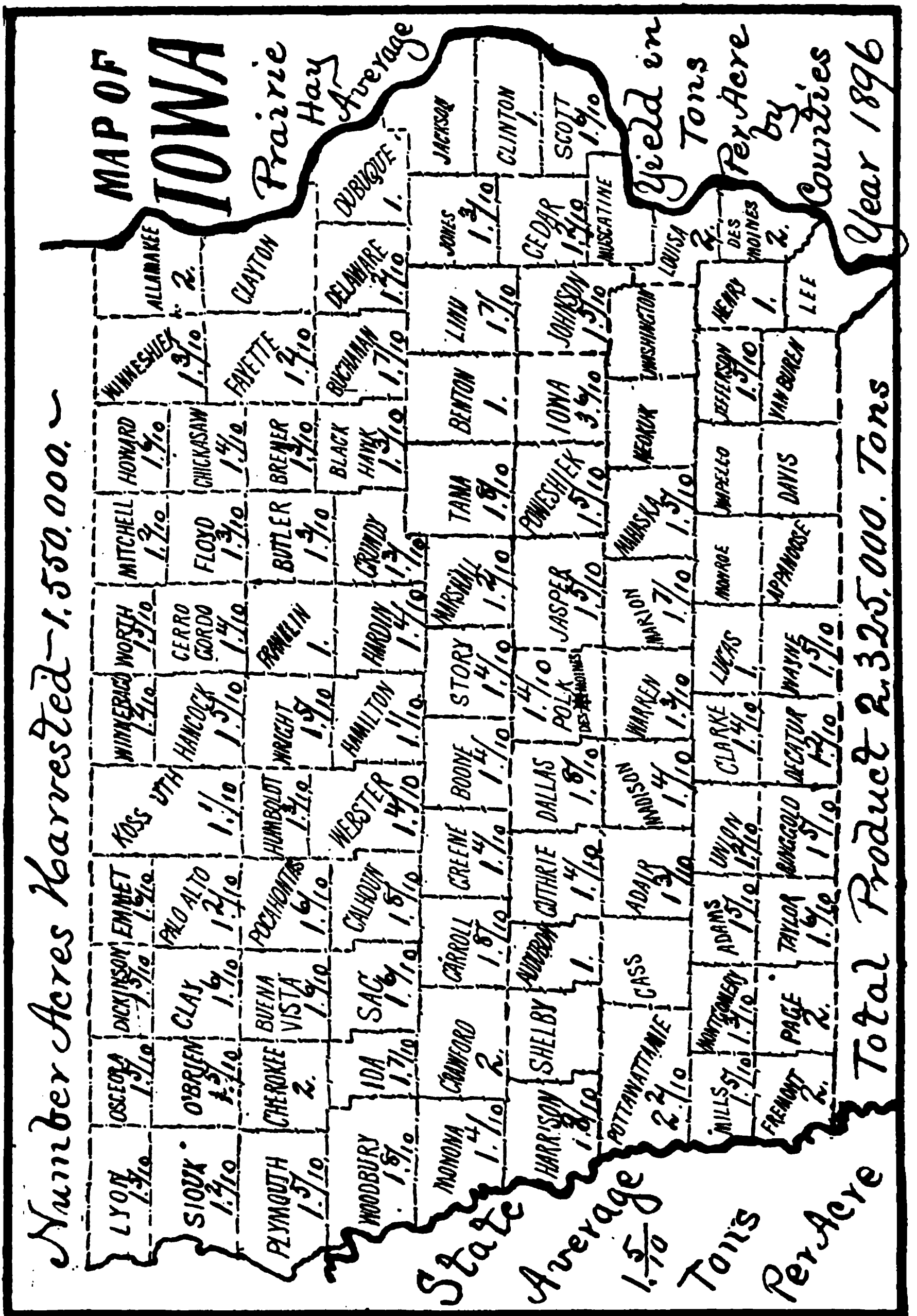
## NOVEMBER.

	cipitation.	Total snow- fall.	TEMPER- ATURE.		
			Mean.	Max.	Min.
26	31.4	23	33.9	71	-4
27	32.2	5	33.3	44	23
28	32.2	5	31.6	53	23
29	34.2	11	30.4	70	01
30	33.8	71	30.4	71	11
31	33.4	39	30.9	68	1
1	33.9	68	30.2	62	63
2	33.9	69	30.9	69	01
3	35.9	75	35.1	75	23
4	35.1	71	35.8	73	31
5	36.8	73	31.7	73	43
6	32.8	71	32.8	71	11

85 1.8 50 2 100 -10 20 77 33.9  
 85 T 20 4 24 -5 20 27 33.9

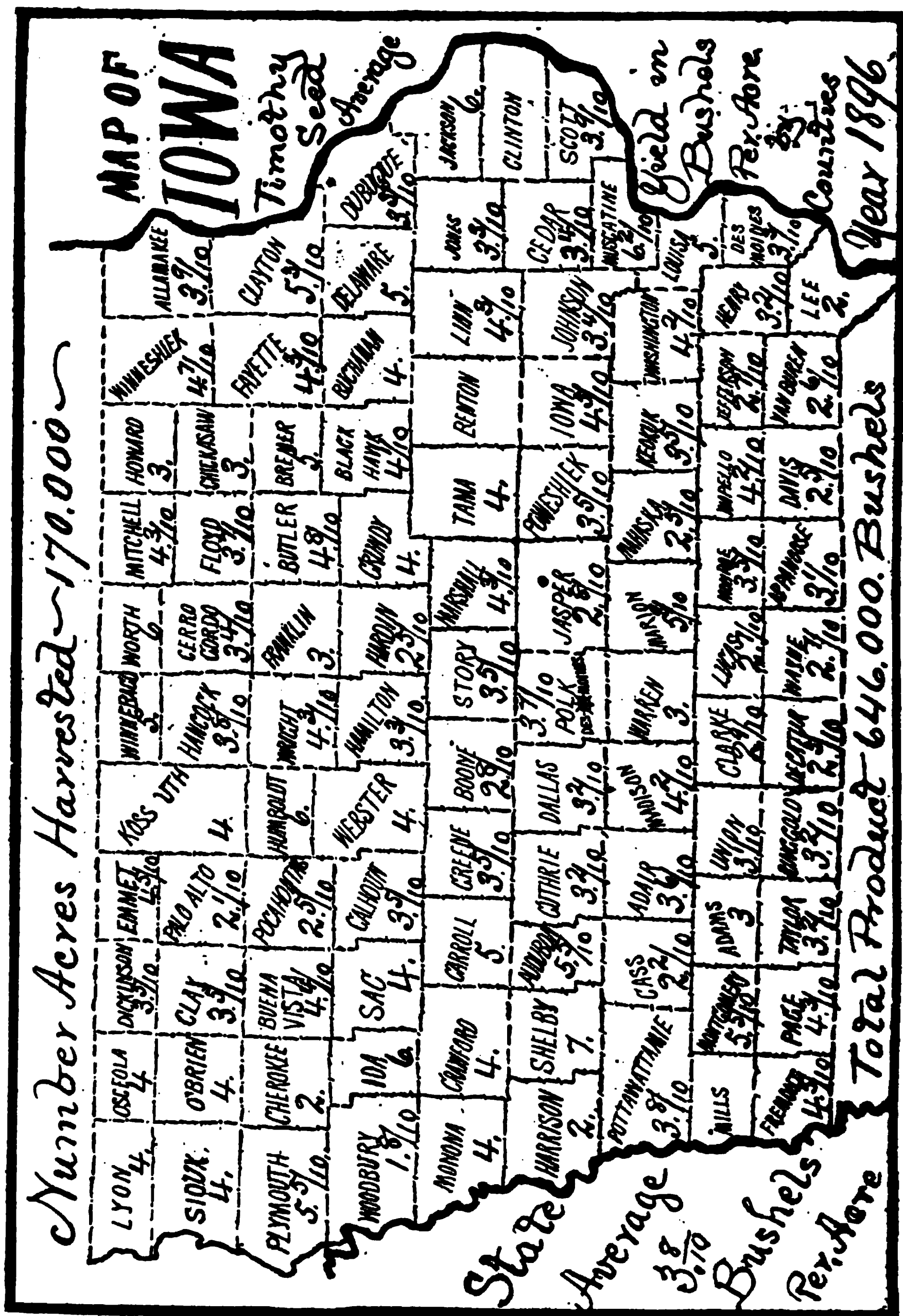








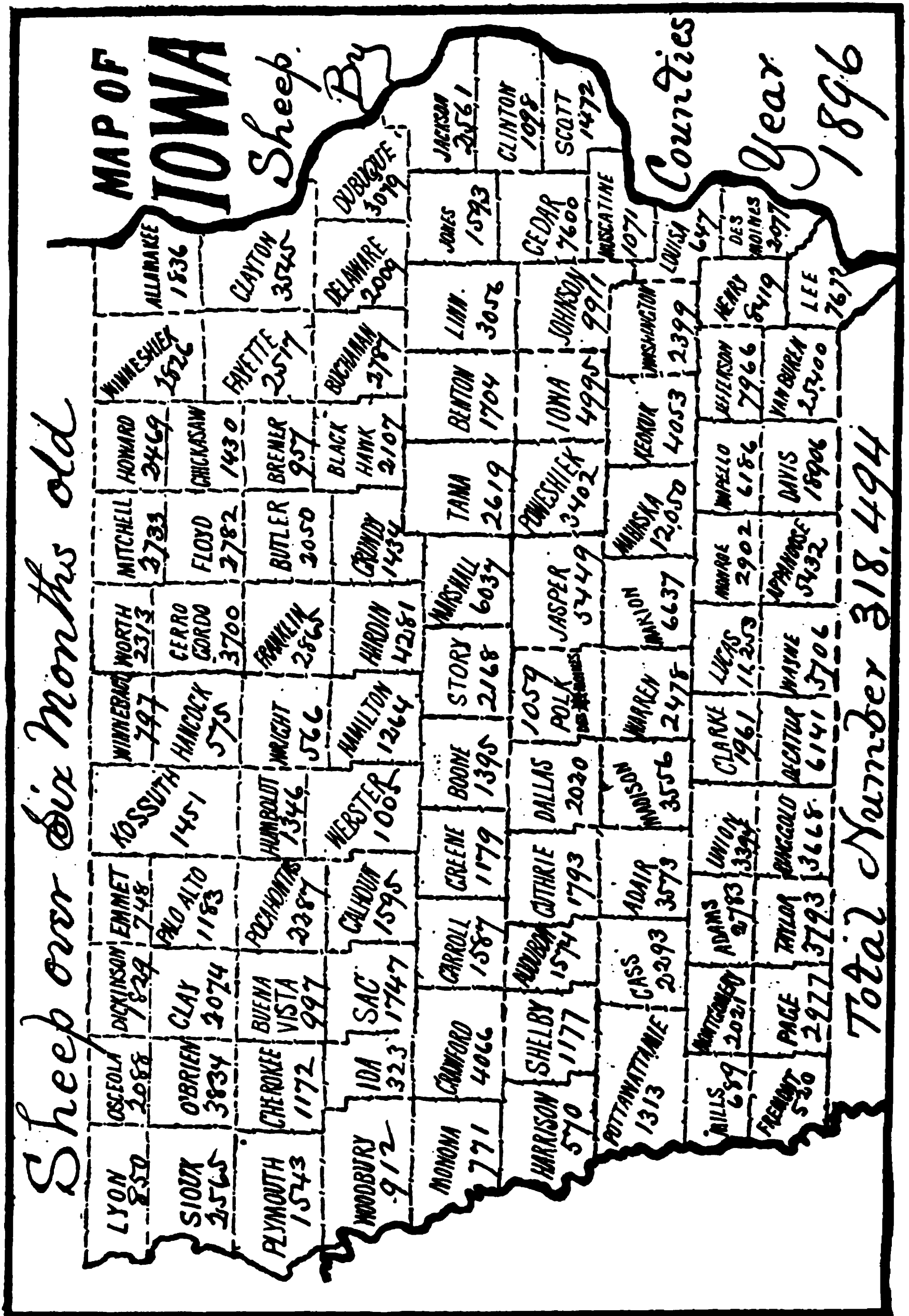












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UNITED STATES  
DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU.

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ANNUAL REPORT

OF THE

Iowa Weather and Crop Service

IN CO-OPERATION WITH THE

UNITED STATES WEATHER BUREAU,

FOR THE YEAR 1897.

---

JOHN R. SAGE,  
*Director.*

GEO. M. CHAPPEL, M. D.,  
*Local Forecast Official U. S. Weather Bureau,  
Assistant Director.*

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PRINTED BY ORDER OF THE GENERAL ASSEMBLY.

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1898.



STATE OF IOWA,  
OFFICE OF THE WEATHER AND CROP SERVICE, }  
DES MOINES, March 30, 1898.

*To His Excellency, Leslie M. Shaw, Governor of Iowa:*

SIR—In accordance with the requirements of the law, we have the honor to submit herewith the eighth annual report of the Iowa Weather and Crop Service for the year 1897.

We are, sir, very respectfully, your obedient servants,

JOHN R. SAGE,  
*Director.*

GEO. M. CHAPPEL,  
*Local Forecast Official U. S. Weather Bureau,*  
*Assistant Director.*



## ANNUAL REPORT, 1897.

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The meteorological and statistical data contained in this annual report have been compiled from the monthly and weekly bulletins issued by the Iowa Weather and Crop Service, in co operation with the Weather Bureau of the U. S. Department of Agriculture. In this condensed form the matter will be especially valuable and convenient for reference and comparison in future years, and that is the special purpose of this compilation.

Steady progress has been made during the year on all lines within the field of work for which this service was established. The work of meteorological observation has been carried on at 135 stations, including six regular stations of the U. S. Weather bureau. Voluntary observers at 129 stations are supplied with government or state instruments, and from the most of them reports are received with a great degree of promptness and regularity. As an auxiliary to this corps of meteorological observers, this service includes over 800 weekly weather-crop observers and monthly crop correspondents. The public spirit displayed by this small army of unpaid observers and reporters is deserving of high praise and just recognition.

The issues of the Monthly Review and weekly Crop Bulletins have been steadily increased to meet the public demand for those publications. The distribution of the Review amounted, during the year, to an average of over 2,500 copies per month, and of the Bulletin the weekly issues amounted to over 2,300 copies. The summaries of the weekly crop reports were very widely disseminated through the press of this state, and the leading daily and commercial papers of the whole country. The value of the climate and crop reports of the foremost agricultural state in the union is fully recognized by all classes of people engaged in commerce or production.

At the close of the year, daily forecasts were received by telegraph at 112 stations; and forecasts were distributed by mail from these telegraph stations to more than 1,000 post-offices within this state. By these agencies a very large percentage of the people received the forecasts in time to be serviceable.



Following is a list of stations equipped with meteorological instruments, and the names of observers from whom reports were received during the year 1897.

## METEOROLOGICAL STATIONS AND OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Adair.....	F. L. Morrison.	Keosauqua.....	Prof. J. H. Landen.
Afton.....	Hon. N. W. Rowell.	Knoxville.....	Oasey and Beaver.
Albia.....	Cal. Koontz.	Lamoni.....	T. J. Fitzpatrick.
Algona.....	O. D. Pettibone.	Le Claire.....	River Observer.
Alta.....	D. E. Hadden.	Lansing.....	G. H. Markley.
Alta (near).....	W. J. Minard.	Larchwood.....	E. W. Stokes.
Amana.....	Conrad Schadt.	Larrabee.....	H. B. Strever.
Ames.....	Exp. Station.	Lenox.....	J. L. Hurley.
Ames (6 miles s.e.)	Isaac Young.	Le Mars.....	Dr. T. E. Cole.
Atlantic.....	J. W. Love.	†Linn Grove.....	Rev. J. W. Hubbard.
Audubon.....	F. P. Hocker.	Logan.....	Mrs. M. B. Stern.
Belknap.....	A. W. Rankin.	Malvern.....	
Belle Plaine.....	S. P. Vandike.	Maquoketa.....	
Bonaparte.....	Hon. B. E. Vale.	Mason City.....	
Britt.....	G. P. Hardwick.	Marshalltown.....	
Burlington.....	Prof. H. H. Severn.	Millman.....	
Carroll.....	Moses Simon.	Monticello.....	
Charles City.....	H. O. Andresen.	Moor.....	
Cedar Falls.....	Prof. A. O. Page.	Mount Vernon.....	
Cedar Rapids.....	Electric L. & Power Co.	Mt. Ayr.....	
Centerville.....	Prof. H. E. Reister.	Mt. Pleasant.....	
Chariton.....	Hon. S. H. Mallory.	Neola.....	
Clarinda.....	A. S. Van Sandt.	New Hampton.....	
Clear Lake.....	Wm. Gray.	Newton.....	
Clinton.....	Lake Roberts.	Northwood.....	
College Springs.....	A. M. Finley.	Odebolt.....	
Corning.....	John W. Birby.	Ogden.....	
Council Bluffs.....	J. B. Rishel.	Omaha, Neb.....	
Oresco.....	Gregory Marshall.	Oscola.....	
Davenport.....	*Geo. E. Hunt.	Ovid.....	
Delaware.....	Wm. Ball.	Osage.....	
Decorah.....	F. H. Baker.	Oskaloosa.....	
Denison.....	Wm. A. McHenry.		
Des Moines.....	*Geo. M. Chappel, M. D.		
De Soto.....	E. D. Minard.		
Dows.....	E. E. Fuller.		
Dubuque.....	*L. M. Tarr.		
Eldora.....	Prof. C. F. Woodward.		
Elkader.....	Chas. Reinecke.		
Etherville.....	M. L. Archer.		
Exira.....	G. W. Gurnsey.		
Fairfield.....	Charles J. Fulton.		
Fayette.....	R. Z. Latimer.		
Ft. Madison.....	Miss L. A. McCready.		
Fonda.....	Chas. F. Linnan.		
Forest City.....	J. A. Peters.		
Fredericksburg.....	O. E. Wright.		
Galva.....	Jay Crowley.		
Garden Grove.....	M. Wemple.	Spencer.....	Prof. E. H. Griffin.
Gladbrook.....	Geo. F. Parker.	Spirit Lake.....	*U. G. Purcell.
Glenwood.....	J. P. Jackson.	Stuart.....	Dr. O. Brown.
†Grand Meadow.....	F. L. Williams.	Tara.....	S. Gillespie.
Greene.....	J. L. Cole.	Thurman.....	W. C. Drummond.
Greenfield.....	J. G. Oulver.	Toledo.....	H. M. Bartlett.
Grinnell.....	Prof. S. J. Buck.	Vinton.....	J. L. Haynes.
Grundy Center.....	Geo. F. Ellis.	Villisca.....	O. B. Paul.
Guthrie Center.....	Henry Priebe.	Washington.....	Chas. Mason.
Hampton.....	E. O. Grenelle.	Washta.....	T. F. McCune.
Hedrick.....	J. T. Brooks.	Waterloo.....	J. F. McCartney.
Hawkeye.....	Miss I. Whorley.	Waverly.....	Wm. A. Cook.
Hopeville.....	M. T. Ashley.	Waukees.....	H. L. Felter.
Humboldt.....	H. S. Wells.	Webster City.....	M. L. Newton.
Independence.....	E. F. Wulke.	Whitten.....	E. S. Hoover.
Indianola.....	Prof. J. L. Tilton.	Wilton Junction.....	N. O. Wragg.
Iowa City.....	Prof. A. A. Veblen.	Winterset.....	Louis Frank.
Iowa City.....	Mrs. O. M. Hobby.	West Bend.....	Dr. Frank P. Butler.
Iowa Falls.....	J. B. Parmelee.	West Union.....	J. M. Rider.
Keokuk.....	*Fred Z. Gosewisch.	West Branch.....	W. W. McKnight.
			Phil Dorweiler.
			J. W. Bopp.
			A. A. Madison.

\*U. S. Weather Bureau. †Postville P. O. ‡Mt. Vernon P. O.

## WEATHER-CROP OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Agency .....	J. H. Van Zant.	Lockridge .....	J
Albia .....	Wm. Mercer.	Marshalltown ..	H
Alta .....	Jonas Cushman.	Mason City .....	W
Ames .....	S. B. Mills.	Mapleton .....	A
Atwood .....	J. H. Tanner.	Mt. Pleasant .....	W
Battle Creek .....	A. Preston.	Milton .....	H
Boone .....	L. O. Morris.	Mount Vernon ..	B
Centerville .....	Henry Galley.	North English ..	J
Charles City .....	W. B. Townner.	Nevada .....	G
Chariton .....	O. O. Burr.	Olin .....	H
Clarksville .....	F. M. Russell.	Osage .....	H
Correctionville ..	Hon. W. B. Chapman.	Orange City ..	H
Corning .....	Jerome Smith.	Paton .....	A
Corwith .....	Wm. Oxley.	Pittsburg .....	G
Clermont .....	Chas Larrabee.	Rockford .....	H
Council Bluffs ..	L. Prouty.	Rock Rapids ..	D
Oreston .....	M. V. Ashby.	Rockwell City ..	J
Danville .....	Sherman Matthews.	Rossville .....	T
Emerson .....	D. B. Nims.	Rowley .....	L
Ely .....	Hon. A. J. Fuhrmeister.	Ruthven .....	F
Fulton .....	Carl S. Frank.	Sareville .....	H
Ford .....	J. O. Richards.	Seymour .....	L
Fort Dodge .....	R. W. Blaine.	Shenandoah ..	R
Geneva .....	Wm. H. Thompson.	South Amana ..	J
Grinnell .....	A. O. Price.	Spirit Lake ..	L
Guthrie Center ..	W. W. Bailey.	State Center ..	E
Hesper .....	G. E. Dillingham.	Sumner .....	J
Hodge .....	James Piper.	Tama .....	W
Humeston .....	Hon. S. H. Moore.	Unity .....	E
Independence ..	O. L. Thomas.	Van Horne .....	Spencer Smith.
Jefferson .....	S. M. Taylor.	Willow Creek ..	W. S. Nicholson.
Knoxville .....	G. W. Mendenhall.	Winterset .....	H. A. Kinsman.
Larrabee .....	H. H. Carnahan.	Wall Lake .....	T. E. Wilcox.
Le Mars .....	Hon. Henry Schrooten.	Wilton .....	Thos. Boot.
Lawler .....	Hon. Wm. Glattly.		

## METEOROLOGICAL SUMMARY FOR 1897.

The mean barometric pressure for the year was 30.05 inches, with a range for the state of 1.70 inches. The highest observed was 30.90 inches at Clarinda, February 26th, and the lowest was 29.20 inches at Davenport, on March 19th.

The mean temperature of the state for the year, as deduced from the complete records of eighty-one stations, was 46.7°. The station at Malvern recorded the highest temperature for the year, 106°, on July 23d and September 1st. The lowest temperature recorded was 30° below zero, at Rock Rapids and Elkader, on January 26th and 26th.

The average precipitation reported from eighty-four stations was 26.99 inches, which amount is several inches below the normal for Iowa. Winterset reported a total of 36.18 inches for the year. The least amount was 20.21 inches, recorded at Spirit Lake. The average number of days on which rainfall was recorded was 77. There were 158 clear days during the year, 102 cloudy, and 105 partly cloudy.

## WEATHER AT DES MOINES, 1897.

### COMPARISON WITH PRECEDING YEAR.

The mean temperature in 1897 was  $49.6^{\circ}$ , against  $50.1^{\circ}$  for the year preceding. The highest temperature was  $98^{\circ}$  above, September 1st, against  $95^{\circ}$  above on July 14, 1896. The lowest temperature was  $17^{\circ}$  below, January 25th, against  $8^{\circ}$  below on January 4, 1896. The mean relative humidity was 69 per cent against 70 per cent during the preceding year.

The total precipitation in inches during 1897 was 27.07, against 37.09 in 1896. The deficiency from the average rainfall last year was 6.04 inches, against an excess of 3.93 inches the year before. The greatest precipitation in any twenty-four hours was 2.95 inches against 3.29 inches in the year before. The total depth of snowfall was 49 inches, against 19.7 inches in 1896.

The percentage of sunshine was 59, against 58 in 1896. The average hourly wind movement was 8.10 both years. The prevailing direction in 1897 was southwest, and the year preceding, north. The highest velocity was fifty miles an hour, from the northwest, against forty the year before from the southeast. There were forty-two days during which thunder was heard, against fifty-two in the preceding year.

## MONTHLY WEATHER SUMMARIES—1897.

### JANUARY.

The mean temperature of the month was  $17.2^{\circ}$ , which is slightly above the January normal. The weather was unseasonably warm most of the time during the first and second decades; extremely cold prevailed in all parts of the state from the 23d to the 30th, with zero temperature most of time. The mean was at or below zero on the 24th, 25th, 26th and 27th. The lowest temperature reported was  $30^{\circ}$  below zero at Elkader on the 26th and at Rock Rapids on the 25th; highest reported,  $66^{\circ}$  at Keokuk and Madrid on the 1st.

The average precipitation for the state was 2.01 inches. Fort Madison reported 6.16 inches and Portsmouth .15 of an inch. There were 12 clear days, 12 cloudy and 7 partly cloudy.

### FEBRUARY.

The mean temperature for February for the state was  $24.6^{\circ}$ , which is above the normal. The average precipitation for the state was .88 of an inch, which is below the normal for the month. There was an unusual prevalence of cloudy and damp weather, the largest excess of cloudiness

and humidity being reported in the eastern districts. At the central station the amount of sunshine was 48 per cent; the number of cloudy days 13, clear days 7, and partly cloudy 8.

#### MARCH.

The mean temperature for the state was 32°, or slightly above the March normal. There was a wide range of temperature recorded, the highest being 72° at Bonaparte on the 19th, and the lowest 22° below zero at Rock Rapids on the 14th. The average monthly range was 67.3° for the state.

The average precipitation was 2.39 inches, which is a little above the normal. Stuart reported 6.16 inches, and the I. A. C. station at Ames only .39 for the month.

There were only 9 clear days, 14 cloudy days, and 8 partly cloudy. The soil at the close of the month was generally too wet for farming operations.

#### OBSERVERS' NOTES.

*Bonaparte*—B. R. VALE: A very wet, cloudy and disagreeable month. Soil full of water and the prospect for spring work is quite distant.

*Fayette*—R. Z. LATIMER: Ice went out of the river on the 11th. Frost out in places; roads quite bad. Ground too wet for seeding.

*Garden Grove*—M. WEMPLE: A nasty month; no farming done. Grass beginning to grow.

*Grand Meadow*—F. L. WILLIAMS: Ground very wet. Frost nearly out. Spring work very backward.

*Greene*—J. L. COLE: Ice went out of Shell Rock river, doing considerable damage to mill dam and some buildings. On 31st high wind.

*Logan*—M. B. STERN: The month has been remarkable for cloudy, cold and foggy weather with but little sunshine.

*Oskaloosa*—JOSEPH BOYD: The month was cloudy and backward. The month closed with the ground full of water. ●

*Ovid*—H. C. MILLER: Blue birds and larks arrived the 8th. First frogs peeping 17th. Meadows and pastures getting green.

*Primghar*—E. S. PROPER: Snow and ice went out all at once with a rush, carrying out several bridges in this county. A backward spring.

*Sigourney*—E. H. GRIFFIN: There is more moisture in the ground than for a number of years. Farmers report sloughs very wet. Wells that have not furnished water for six years now have an abundance.

*West Bend*—PHILIP DORWEILER: Latter part of the month snow melting fast and creeks and rivers rising, doing considerable damage to bridges. Farm work commenced the last of the month.

*Keokuk*—F. GOSEWISCH: Country roads bottomless, and ground so wet that horses cannot work in fields; no spring work done yet. Damage to winter wheat is estimated from 50 to 75 per cent winter-killed.

#### APRIL.

The month of April was notable for the prevalence of wet, cool and cloudy weather, and excessive rainfall. The mean temperature was 47.9°, which is about the normal for the state. The amount of sunshine was abnormally low in all parts of the state, the records at the central station showing only 47 per cent for the full month.

The average rainfall was 5.35 inches, which amount is 2.75 inches above the April normal. The measurements reported in the central and southern districts were much higher than in the northern belt. The greatest amount reported was 9.86 inches, at Winterset, and the lowest amount, 2.22 inches, at Northwood. As a result of these conditions the farming season was two weeks late at the close of the month.

## OBSERVERS' NOTES.

*Amana*—CONRAD SCHADT: The month was wet, cold and rough and very hard and trying on the farmer. Much plowing and seeding had to be left for May. The killing frost of the 19th and 20th hardly found anything to be killed, as the season is unusually backward.

*Atlantic*—J. W. LOVE: Severe hailstorm on the evening of the 22d; hail lay on the ground from 2 to 4 inches deep.

*Atlantic*—GEO. W. FRANKLIN: No damaging frosts yet; plenty of rain. Cellars have water in them. Spring two weeks late. Pastures and meadows good. Clover and winter wheat killed.

*Bonaparte*—HON. B. R. VALE: A cold, cloudy and wet month. But little progress made in agriculture. Seeds in soil germinating badly. The lack of light and heat was very injurious to all young animals.

*Logan*—MRS. M. B. STERN: The month has been unusually rainy, with a heavy thunderstorm on the 22d. No heavy frosts.

*Monticello*—HENRY D. SMITH: April, 1897, breaks the record with 5.86 inches rainfall.

*Oskaloosa*—JOS. BOYD: April was very backward with an unusual amount of rainfall.

*Ovid*—H. C. MILLER: A cold, wet month, with but few clear days. Hickory and oak buds opened ten days later than last year. Wild plum bloom out last year on the 18th, this year on the 28th. All broken lands flooded on the 23d, 24th and 25th.

*Primghar*—E. S. PROPER: Season two weeks late. Continued cold weather and rains kept the farmers out of fields. Small grain all sown in this section now.

*West Bend*—PHIL. DORWEILER: A wet month and farm work very backward. Willow leafing on the 25th, and maple on the 27th.

## MAY.

The month was cooler and drier than usual. The mean temperature for the state at large was 59.6°, which is 1.5° below the normal. During the past twenty years there have been nine colder Mays than this, the normal for the state being 60°. At the central station the range for May, in nineteen years, has been 13°, or from the mean of 55° to 68°. The coldest May recorded was in 1888, and the warmest in 1881.

The average precipitation for the month was 1.92 inches, which is 2.26 inches below the normal. The highest amount reported was 3.59 inches at Indianola; least amount, .21 of an inch at Larchwood, Lyon county. The northwest and southeast districts received the least amount of moisture.

## OBSERVERS' NOTES.

*Belle Plaine*—S. P. VANDIKE: Considerable damage to corn and fruit by the heavy frost of the 31st. All tender garden vegetables killed or injured.

*Bonaparte*—HON. B. R. VALE: A cold, cloudy and dry month, following an excessive wet spring, rendered it adverse to agriculture and the interests of the stockman and breeder.

*Cresco*—GREGORY MARSHALL: Thirty-first. Killing frost this morning; corn and potatoes killed to the ground; berries badly hurt; damage to apples not yet known. Ice, one-fourth inch.

*Estherville*—M. L. AROHER: Thirty-first. Vegetables and corn cut down. Ice formed on standing water.

*Fayette*—R. Z. LATIMER: The frost on the 30th did a great deal of damage, cutting nearly all early vegetation to the ground, and killing grapes, apples, raspberries, blackberries and early strawberries.

*Ft. Madison*—MISS L. A. MCCREADY: Small fruit is plentiful, such as cherries, currants and gooseberries. There are few peaches. This has been a very cold, backward month.

*Garden Grove*—M. WEMPLE: Cold, dry and backward. No oats; everybody replanting corn because of cold and worms.

*Grand Meadow*—F. L. WILLIAMS: The month has been one of extremes of temperature, with severe frosts at the latter end, doing a great deal of damage to tender vegetation; crop prospects poor.

*Larrabee*—H. B. STREEVER: May will, in this section, go on record as cold and dry. Frosts on the 24th, 30th and 31st insts. damaged corn and tender garden vegetables somewhat.

*Logan*—MRS. M. B. STERN: The month has been unusually cold, but no hard frosts. Cold and too dry for tender vegetation. The season is at least two weeks late.

*Mt. Ayr*—J. W. BEARD: The low temperature of the month has kept the corn back and given the worms a chance to work on it.

*New Hampton*—C. L. GABRILSON: Corn and potatoes and tender garden truck were frozen to the ground on the morning of the 31st.

*Osage*—G. D. PATTINGILL: Frost on ten mornings; ice formed to quite a thickness on the morning of the 31st.

*Oskaloosa*—JOSEPH BOYD: The month was very backward. Crops and garden stuff made slow growth.

*Primghar*—E. S. PROPER: This has been a remarkably cool month; season over two weeks late, with three killing frosts in last part. Corn is not growing well on account of cold. Small grain doing well; also pasture. Fruit not hurt much yet.

*Toledo*—CHARLES MASON: Four frosts occurred during the month, the latter one, on the 31st, doing a good deal of damage; 50 per cent of grapes killed; strawberries badly injured; season ten days late.

*Waverly*—H. S. HOOVER: Plum blossoms first appeared on the 6th. First corn planted the 7th. Freeze on the 31st killed all tender plants generally; a few localities escaped.

*West Bend*—PHIL DORWEILER: Month dry and cool, and vegetation is backward; light frosts were many, with killing frost on the 31st.

## JUNE.

The mean temperature of the month was 69.1°, which is .5° below the June normal. The first decade was unseasonably cool, the second excessively warm, and the third about an average, giving an unusual variety and range of temperature. The maximum recorded was 103° at Sigourney on the 17th; the lowest 29° at Decorah and Lansing on the 1st.

The average rainfall for the state was 3.81 inches, which is .78 of an inch below the normal for June. It was quite unequally distributed, the highest measurement reported being 9.38 inches at Keosauqua, and the lowest 1.03 inches at Rockwell City. The southeastern district received the greatest amount of rainfall, though some excessive measurements are reported from other districts.

There were about the usual number of severe local storms, accompanied by wind squalls, electric force and some hail. At Sioux City, on the 18th, the wind reached the maximum velocity of 72 miles an hour. On that date a windstorm of much force passed through portions of Monroe and Mahaska counties. At Maxon an observer noted a funnel-shaped cloud moving to the northeast at 11:15 A. M., but no serious damage occurred in that vicinity. A similar storm cloud swept through Mahaska county, between Oskaloosa and Rose Hill, causing some damage to buildings, trees and telegraph wires, but no extensive loss resulted. It was probably a violent squall that assumed some of the characteristics of a tornado.

The most extensive and destructive storm of the month occurred on the 23d, accompanied by some hail and lightning, covering a belt of six to ten miles wide reaching two-thirds of the distance across the state, from west to east, through the central and east central districts.

## OBSERVERS' NOTES.

*Bonaparte*—HON. B. R. VALE: There was 5.08 inches of rain in the last nine days as against 1.95 in fifty-eight days previous. A very wet and gloomy close of the month from the farmer's standpoint.

*Delaware*—WILLIAM BALL: John Maxwell, of Milo township, was killed by lightning on the 23d. Fred Green, of South Fork township, was struck by lightning and fatally burned on the 23d.

*Garden Grove*—M. WEMPLE: All farm products have made great growth during the last half of the month. Oats light; corn late; meadows much improved. No violent storms.

*Grand Meadow*—F. L. WILLIAMS: June 4th, at 8 P. M., there was a thunderstorm with vivid lightning and heavy thunder. The morning of the 5th about 5 o'clock there was a long peal of thunder out of a clear sky; the rumbling seemed like an earthquake. Month very warm from the 10th on, and unusually wet.

*Grundy Center*—GEORGE F. ELLIS: June 19th, at 1 A. M., there were thunderstorms from the southwest with bolts of zigzag lightning very sharp. A large barn owned by J. M. Sprague, of Palermo township, was struck by lightning, killing five head of horses and burning the barn and contents consisting of 120 tons of tame hay, 250 bushels of oats, 2,800 bushels of corn, and crib, and all farm implements. Loss, \$2,000.



*Humboldt*—HENRY S. WELLS: Thunder on the 9th, 10th, 18th and 23d. Some cattle killed by lightning. No other damage. Crops all doing well. Corn will soon recover and be equal to past year.

*Iowa Falls*—J. B. PARMELEE: June 4th, light frost; 8th, first ripe strawberries; 22d, oats beginning to head.

*Keosauqua*—PROF. J. H. LANDES: Thunderstorms on the 24th. Quite a number of cattle were killed over the country and houses were struck.

*Larrabee*—H. B. STREVER: Month opened cool and dry. All crops backward till the middle of the month, after which date growth was stimulated by sufficient heat and moisture and all vegetation bounded forward remarkably.

*Logan*—MRS. M. B. STERN: The early part of the month was dry and cold, but warm days and frequent showers have helped the growth of all kinds of vegetation. No bad storms.

*Marshalltown*—C. M. COOK: Frost on night of 3d; thunderstorm on 18th at 2 A. M. Rain on the 23d; hail  $\frac{1}{4}$  of an inch in diameter fell.

*Mt. Ayr*—A. F. BEARD: On the morning of the 30th we had 1.89 inches of rain from 5 to 6 o'clock.

*Oskaloosa*—JOS. BOYD: There was some very sharp lightning during the month. Houses and trees were struck and some stock killed.

#### JULY.

The month of July was warmer and drier than usual. The monthly mean for the state, as deduced from 104 station reports, was  $75.6^{\circ}$ , which is about  $1.6^{\circ}$  above the normal. The highest temperature reported was  $106^{\circ}$ , at Malvern, on the 23d, and the lowest was  $42^{\circ}$ , at Rockwell City, on the 12th. The first decade was an excessively hot period, the mean at numerous points being above  $80^{\circ}$ .

The average rainfall for the state was 3.26 inches, which is about an inch below the normal for July. The largest amount reported was 7.60 inches, at Stuart; least amount, 1.01 inches, at Osceola. Washington reported the heaviest measurement for a single day, viz: 4.80 inches, which fell on the night of the 23d and morning of the 24th.

For the whole state there were 18 clear days, 10 partly cloudy and 3 cloudy.

#### OBSERVERS' NOTES.

*Alta*—DAVID E. HADDEN: July 3d. Heavy thunderstorm, accompanied by sharp lightning and strong wind from southwest. Large limbs from trees were broken, and some outbuildings near town were blown down.

July 23d. Sharp thunderstorm, with very heavy rain; 1.65 inches water fell in 1 hour and 10 minutes.

July 1st. Heavy fog in early morning.

July 31st. Aurora, first noticed at 9:30 P. M., when it had dark segment and active streamers. From 9:40 to 11 P. M. it was quiescent. At 11 P. M. waving curtains of parallel bars moved rapidly from east to west, at an altitude of  $35^{\circ}$  to  $40^{\circ}$ .

*Bonaparte*—FON. B. R. VALE: A very warm and close month, killing many work horses and some swine in feeding. The storm of the 23d did some damage to crops.



*Chariton*—HON. S. H. MALLORY: Terrific electric storm midnight of 24th, of about one hour duration.

*Garden Grove*—M. WEMPLE: The month has been an all-round good month. No storms, plenty of moisture to the present. Hay and grain all secured.

*Keosauqua*—PROF. J. H. LANDES: On the night of the 23d there was a severe windstorm accompanied by heavy thunder and fierce lightning. Many objects were struck by lightning and some damage resulted from wind.

*Larrabee*—H. B. STREVER: July weather conditions have been rather unfavorable for the ripening of small grain, but corn has pushed forward wonderfully. A severe hailstorm visited the territory west of Cherokee on the evening of the 29th.

*Ovid*—H. C. MILLER: A severe electric storm on the afternoon of the 24th. One man killed near Humeston. A barn destroyed in Clay township and one in Corydon. Most of the telephone fuses burned out at Corydon and Seymour; several persons badly shocked and some stock killed.

*Plover*—J. S. SMITH: Very heavy wind morning of the 31st; blew grain in shock badly.

*Sidney*—G. V. SWEARINGEN: Duststorm 31st and high wind all day with warm gusts, which wilted all vegetation greatly.

*Thurman*—A. R. PAUL: Hot wind in P. M. of 31st.

*Washta*—H. L. FELTER: A very heavy wind on the night of the 29th that did some damage to crops. Considerable lightning but no rain in this neighborhood, but in some parts of the county a little hail fell.

*Waukec*—N. C. WRAGG: Bad storm on night of 23d; lightning and wind did some damage.

#### AUGUST.

The month was cooler and drier than usual. The mean temperature was 63.9°, as shown by 107 station reports. That is 2.4° below the normal for August. Light frosts occurred on several dates, and on the 29th the temperature was low enough to kill corn on low ground in numerous localities in the northern districts. The lowest temperature reported was 35°, at Mason City on the 29th; and in that vicinity the effects of frost were most observed.

The average rainfall was 1.86 inches, which is 1.39 below normal. The distribution was quite unequal, the range being from .47 of an inch near Ames to 4.98 at Logan. There were 15 clear days, 5 cloudy and 11 partly cloudy.

The most destructive storm of the month occurred on the evening of the 20th, sweeping over extensive portions of Plymouth and Woodbury counties. The damage was chiefly caused by hail of unusual size and quantity. The extent of territory swept by the storm has been variously estimated at from 100 to 200 square miles, wherein the damage was very heavy. Corn and fruit suffered most, and were partly covered by insurance.

#### OBSERVERS' NOTES.

*Alta*—DAVID E. HADDEN: Hail damaged corn to some extent on August 7th in eastern part of county.

*Amana*—C. SCHADT: The drouth continued to the end of the month. The soil is so dry that no plowing is possible. Crops are suffering from its effects.

*Belknap*—A. W. RANKIN: Heavy hail on the 3d did great damage.

*Bonaparte*—HON. B. R. VALE: A cool, dry month. Slight frost on the 25th. Corn matured slowly. But little fall work done.

*Britt*—GEO. P. HARDWICK: On the 7th, at 5:30 P. M., a severe storm from the northwest assumed cyclonic proportions accompanied by rain, 2.21 inches, including hail which, in places, formed into drifts, parts of which remained twenty-four hours. The storm continued in a southeasterly course, widening to several miles. Buildings were blown down, crops on some farms totally destroyed or made unfit for harvest. One young man and some stock killed near Klemme.

*Cresco*—G. MARSHALL: Light frosts on the 20th and 30th; no harm to vegetation.

*Forest City*—J. A. PETERS: On the afternoon of the 7th a severe hail and windstorm passed over a portion of the northern half of the county (Eden township), all crops being destroyed in its path, which was from a half to one mile in length. Mean temperature for the month has been about 6° below normal.

*Grand Meadow*—F. L. WILLIAMS: The month has been cool and very dry. Pastures are suffering for rain. Corn very late; needs three weeks to ripen.

*Humboldt*—HENRY S. WELLS: In two weeks the great bulk of the corn crop will be safe from frost. Some rain will help fall plowing. This year is rounding up better than for several years. No frost so far.

*Logan*—M. B. STERN: A damaging hail passed over a small part of the county on the 20th. Did not cover a large area, but cut corn and gardens quite badly where it passed.

*Monticello*—A. MATTHIESSEN: Very heavy dews; very severe lightning on the night of the 24th.

*Newton*—A. LUFKIN: Rainfall for first eight months of 1896, 36.03; for 1897, 21.51; excess of 1896 over 1897, 14.96 inches.

*Ovid*—H. C. MILLER: Hot winds on the 1st, 2d and 13th; light frosts on the 20th and 30th, but only on low ground and no damage was done.

*Sidney*—G. V. SWEARINGEN: Thunderstorms on the 13th, 17th and 24th. One house in town struck—damage nominal. Duststorms on the 28th and 31st. Too much dry weather.

*Toledo*—CHARLES MASON: The small amount of rainfall in the past summer months is telling on the corn crop at this time; also all other fall crops are in great need of rain, roads are very dusty, pastures have ceased to grow and are about all eaten up, and stock will have to be fed from winter stores unless good rains come soon.

*Washta*—H. L. FELTER: A good many cold nights during the month; the ground too dry for fall plowing.

*West Bend*—PHIL. DORWEILER: Month cool and dry, and not favorable for corn; no frost during the month, but close to it on several nights.

## SEPTEMBER.

September, 1897, will long be remembered as a month of excessively high temperature; the average for the month as obtained from 105 reports was  $70.9^{\circ}$ , which is  $8.7^{\circ}$  above the normal. The temperature was especially high during the first ten days of the month; the maximum during those days ranged from  $90$  to  $100^{\circ}$  or over in the larger portion of the state, accompanied by brisk and dry winds, prematurely drying up the corn and pastures. The coolest part of the month, and in fact the only cool part of the month, was between the 16th and 21st. Light frosts occurred in the northern half of the state on the 17th, and general frosts on the 20th, being heavy to killing in the northern portion, and light to heavy in the southern portion. During the last eight days of the month the temperature was again high. There was an average of fifteen days during the month on which the temperature was  $90^{\circ}$  or above.

The average rainfall was 2.04 inches, or 1.40 inches below the September normal. Showers were quite general on the 1st and 2d, and in many localities they were heavy. Light and scattering showers occurred in the northern portion of the state on the 4th and 5th. Well distributed showers occurred on the 14th and 15th, with general rains on the 16th, which gave temporary relief to pastures, but as no rain fell in any part of the state after the 16th pastures were again dry before the close of the month, and corn was being picked and cribbed. The soil is too dry to plow and what fall grain has been sown is suffering for want of moisture.

## OBSERVERS' NOTES.

*Afton*—N. W. ROWELL: Frost on the 20th on low lands.

*Algona*—C. D. PETTIBONE: First frost of the season on the 17th. No damage.

*Alta*—PROF. DAVID E. HADDEN: First killing frost in low places on the 17th; more severe on the 20th. A very dry, hot and dusty month. Pastures suffering for rain. Scarcity of water in localities.

*Amana*—CONRAD SCHADT: The month was extraordinarily warm and sunny. With exception of a few rainy days the sky was almost cloudless throughout the month. It closed with a severe drouth which commenced about the middle of the month.

*Belknap*—A. W. RANKIN: This has been a wonderfully dry month, and hot, with scarcely a cloud. The great hail of August 3d well nigh ruined corn, fruit and other crops, only to be completed by the hot, dry weather since, and rounding up with the frost of the 20th and 21st. But at many places in the county crops have been good.

*Bonaparte*—HON. B. R. VALE: An extremely dry and hot month. Corn light and immature. But little seeding done.

*Britt*—GEORGE P. HARDWICK. Exceptionally dry and clear; mild winds.

*Charles City*—HENRY C. ANDRESEN. September 1st, a very hard rain and wind, beginning 12:17 A. M., having three successive showers, rain coming in torrents, ending 5:30 A. M.; sharp lightning and thunder.

*Delaware*—WILLIAM BALL: The thunderstorms of the 10th and 16th did considerable damage. Lightning struck and burned two stores and contents in the town of Delhi on the 10th, and on the 16th burned a large

barn and contents near Delhi, besides killing several head of stock in other parts of the county.

*Forest City*—J. A. PETERS: Killing frosts have occurred as follows since the establishment of a station here: 1894, first killing frost 13th; 1895, 30th; 1896, 20th; 1897, 20th. Mean temperature has been 7° above the normal. There have been no storms. More sunshine than in any month of the year.

*Ft. Madison*—MISS L. A. MCCREADY: We are having a very dry spell of weather; wells and cisterns are giving out and everything is drying up. Corn leaves are so dry you can rub them to powder.

*Grand Meadow*—F. L. WILLIAMS: The rain of the 1st was next to the heaviest ever measured at this station. The month as a whole was extremely warm, with an unusual amount of sunshine.

*Grundy Center*—GEORGE F. ELLIS: On September 1st, at 9 A. M., a thunder shower passed six miles northeast of this station. Lightning struck the German Reform church in Lincoln township, burning the building and contents. Several head of cattle were also killed by the same storm.

*Humboldt*—HENRY S. WELLS: The plowing is greatly retarded by the dry weather. Much of the corn is ready to crib. Hog cholera is bad. Feeding now is the rule.

*Lamoni*—ORRIN DUDLEY: Dry weather. Potatoes and corn suffered for want of rain.

*Logan*—MRS. M. B. STERN: The month has been remarkable for the heat and dryness. For twenty days the mercury has been 90° and upward—an unprecedented record.

*Monticello*—A. MATTHIESSEN: Severe lightning on the night of the 15th. Nights very cool. Frost on some nights, but not severe enough to hurt much. A very dry month.

*Oskaloosa*—JOSEPH BOYD: September was a very warm and dry month, with only one cloudy day.

*Ovid*—H. C. MILLER: Hottest and driest September ever known here; ponds and wells failing; stock water very scarce. This locality is overrun with rats.

*Sidney*—G. V. SWEARINGEN: Thunderstorms from the 10th to the 14th were moderate and no harm done. Wind and duststorms of more or less force from the 1st to the 9th. The hottest September ever known here.

*Toledo*—CHARLES MASON: This is the most remarkable month in all my observations for the past twenty-five years for extreme heat and cloudless days, and absence of winds, also smothering clouds of dust. Water is getting very low and a greater scarcity will be felt unless we have heavy rains before the ground freezes.

*Garden Grove*—M. WEMPLE: A bad month. Everything dried up. No grass; no water; no anything but heat and dust.

*Waterloo*—M. L. NEWTON: Mean temperature for the month, 70°, which is 6.8° above the normal as obtained from fifteen years' record. The total rainfall for month, 2.77 inches, which is 2.40 inches below normal as obtained from fourteen years' record.

#### OCTOBER.

The month of October was unusually warm and dry. The mean temperature for the state was 56.8°, which is 6.8° above the normal. The highest

temperature recorded was 97° at Ottumwa, on the 1st; and at numerous places the records showed maximums above 90° during the first half of the month. The lowest temperature reported was 20° at Plover, on the 29th. There was a prevalence of southerly winds. There were 17 clear, 8 partly cloudy and 6 cloudy days. The average rainfall for the state, as shown by reports from 108 stations, was 1.14 inches—1.64 inches below the normal for October. The bulk of the rain fell between the 10th and the 19th, the balance of the month being almost wholly rainless. The southwest district reports the heaviest rainfall, the amount at Thurman, Fremont county, being 3.30 inches.

It was an ideal month for drying out corn and for securing all outstanding crops in the best condition. Corn was in condition for cribbing ten days earlier than usual, and the work of husking was well advanced at the close of the month. It was dried out perfectly, and though much of it was prematurely ripened, yet it was all sound, and not a bushel of soft corn was cribbed. The condition of the crop is much better than was anticipated, and a larger percentage will be merchantable than was deemed possible a month earlier in the season.

#### OBSERVERS' NOTES.

*Amana*—CONRAD SCHADT: The drouth of September continued till the 11th, when .40 inch fell, with a little sprinkle of .04 on the 16th, and .38 rainfall on the 19th. From this date no rain fell till the close of the month. Nearly all trees kept their green foliage, and tomatoes and very tender flowers, such as Madeira vines, etc., continued to flower and grow until the first killing frost at the end of the month put a stop to the growth of plants.

*Bonaparte*—HON. B. R. VALE: Only 1.33 inches rain since August 3d, and that in six showers. No plowing for corn, and the little seeding has perished. Roads deep with dust. Pastures dried up, and stock water a great object.

*Cresco*—GREGORY MARSHALL: Warmest October on record, except 1879.

*Forest City*—J. A. PETERS: The weather has been very dry; many wells are giving out. Pastures have afforded very little feed.

*Fort Madison*—MISS L. A. MCCREADY: We have not had a good rain since the 3d of last August. Everything is drying up. Farmers say the winter wheat is burned up. Water is very scarce; some have to haul water for use.

*Grand Meadow*—F. L. WILLIAMS: The month has been extremely warm and dry. Corn is as dry as it usually is in January. Pastures got rather short. Plowing and husking well along. Great crop of clover seed is being hulled.

*Greenfield*—J. G. CULVER: Twenty-seventh, sweet peas and tea roses blooming yet, although most of the leaves of the trees have fallen. Twenty-eighth, first ice formed.

*Humboldt*—HENRY S. WELLS: A good month for all farm work except plowing; but the plowing is well along. Wheat averages 15 bushels, oats 35, corn 30, and flax 12.

*Iowa City*—MRS. C. M. HOBBY: Everything very dry. Cisterns and wells empty. Referring to the record for the months of October and

November for the year 1891, there is very little encouragement to hope for rain. With the exception of the year 1895, there have been almost no rainy days, and very few with snow, in the month of November, from 1891 to 1897.

*Lamoni*—O. DUDLEY: No damage done by frosts. Continued drouth bad on wheat.

*Larrabee*—H. B. STREVER: Extreme drouth prevailed until the 15th inst.

*Lenox*—J. L. HURLEY: First ice formed on the 19th, second on the 29th.

*Osceola*—A. W. LEWIS: Tomato vines growing and in full bloom up to 29th.

*Oskaloosa*—JOSEPH BOYD: The month of October was deficient in rainfall, but was very favorable for maturing the corn crop.

*Ovid*—H. C. MILLER: Frost on the 22d did no damage except on low ground. Garden truck all green until the freeze on the 29th. First wild geese seen on the 8th.

#### NOVEMBER.

The month was slightly warmer and drier than usual. The mean temperature for the state was  $34.3^{\circ}$ , which is  $7^{\circ}$  above the normal. There was an average monthly range of over  $77^{\circ}$ . The highest temperature reported was  $81^{\circ}$ , at Iowa City and Albia, on the 20th, and the lowest was  $19^{\circ}$  below zero at Rock Rapids, on the 28th.

The average precipitation for the state was .66 of an inch. Fort Madison reported 2.24 inches, which was the largest amount recorded. Atlantic and Glenwood reported only a trace during the month. There were but 10 cloudy days, 8 partly cloudy and 12 clear. It was, on the whole, a fair and mild November, with less than usual severe storms. The maximum wind velocity was forty-five miles per hour, at Sioux City on the 10th. The general wind movement was below the November normal.

#### OBSERVERS' NOTES.

*Belknap*—A. W. RANKIN: Very dry fall; little or no rain since August 3d. November closes with ground frozen hard and but little stock water, and no snow save a very little on the 15th.

*Bonaparte*—HON. B. R. VALE: A very dry and cool month; excellent for corn harvesting and for hauling. No plowing. Water in ponds and creeks exhausted and wells low.

*Chariton*—S. H. MALLORY: Stock water very scarce. Temperature  $4^{\circ}$  higher than in 1896.

*Ft. Madison*—MISS L. A. MCCREADY: First snow night of 15th. The ground is very hard and dry. We need more rain very badly.

*Grand Meadow*—F. L. WILLIAMS: The month was marked by extremes of temperature; a range of  $74^{\circ}$  in the first ten days. Ground frozen up very dry.

*Humboldt*—HENRY S. WELLS: A wonderful dry month; only four inches of snow; two inches coming the 26th and two the 28th. No prevailing sickness. Stock in healthy condition.

*Lamoni*—ORIN DUDLEY: Corn husking practically completed. Lack of water is the general complaint.

*Larrabee*—H. B. STREVER: Weather unseasonably mild during first two decades of month. Plowing the order of the day during second decade. Mild weather has enabled farmers to plow nearly the average acreage. The plow stopped by frost on the 21st.

*Sidney*—G. V. SWEARINGEN: First killing frost of the season occurred on the 1st. Freezing on the 10th. First snow of the season the 15th. A drop in temperature of 43° in about ten hours on night of 20th.

*Sigourney*—E. H. GRIFFIN: Ground has frozen up very dry. Wells are generally low, and the problem of water for stock is serious. Roads are in excellent condition.

*Washta*—H. L. FELTER: Extreme cold weather the last five days of the month; in one instance 12° below zero.

*Waterloo*—M. L. NEWTON: First snow of the season the 12th. Dense fog with lightning on the 14th.

*West Bend*—PHILIP DORWEILER. A fine month. Stock looks well and roads are good; some sleighing since the 28th, but it did not last.

#### DECEMBER.

The month of December was colder than usual, and there was more than the normal amount of snowfall. The mean temperature of the state, as shown by records of 108 stations, was 10°, which is 5° below the normal. The warmest day was the 9th, on which date the records showed 60° at Denison and Mt. Pleasant. The lowest temperature was 25° below zero at Atlantic on the 18th.

The average precipitation for the state was 1.65 inches, which is .34 of an inch above the December normal in Iowa. It was mainly in the form of snow, which was generally well distributed. The surface was covered with snow more than usual, especially in the northern part of the state. It was a fine, bracing, healthful winter month.

#### OBSERVERS' NOTES.

*Bonaparte*—HON. B. R. VALE: A solid but pleasant month; good roads; good for feeding and healthy for man and beast.

*Britt*—GEORGE P. HARDWICK: Slight blizzard on 5th. Damp, frosty air 8th to 13th. Hard wind 5th, 15th, 24th, 28th and 31st. Unusually good sleighing throughout the month.

*Carroll*—MOSES SIMON: Finest sleighing for years.

*Clarinda*—A. S. VANSANDT: On the morning of the 29th the wind was in the northwest, soon veering to west. It was mild as May and reminded me of what I have read of the chinook. Query: Was it the tail end of one? The snow, which was very compact from previous melting, lost one-third of its depth.

*Forest City*—J. A. PETERS: More snow has fallen during this month than in any month since the establishment of this station.

*Grand Meadow*—F. L. WILLIAMS: The month has averaged very cold only four days above freezing. Sleighing was very fine. Stock doing well prices for hogs, fair.



*Iowa Falls*—J. B. PARMELEE: Fair sleighing from the 3d to the 20th, and the best of sleighing from the 20th to the 29th.

*Larrabee*—H. C. STREVER: Heavy snowfall, excellent sleighing, and absence of snow drifts were chief features of December weather. Good sleighing from the 3d inst. to close of month. Very little frost in ground.

*Lenox*—J. L. HURLEY: Fog of 10th and 12th formed a heavy spear frost on trees and fences, spears being from one inch to one and one-quarter inches long. First ice cut on the 21st and 22d. Nine inches thick and good quality.

*Logan*—MRS. M. B. STERN: The month has been cloudy and cold, but the snow has fallen quietly, without much wind, and so is distributed evenly over the dry ground.

*Monticello*—A. MATTHIESSEN: Very heavy snowstorm on the night of the 4th. Severe thunderstorm on the night of the 10th.

*Odebolt*—E. STARNER: December 4th, chinook at midnight that settled the snow about six inches.

*Sidney*—G. V. SWEARINGEN: The month has been cold. All trees, shrubs, leaves, etc., were beautifully covered with ice and frost from the 9th to the 12th, and from the 19th to the 22d.

*Sigourney*—E. H. GRIFFIN: On the 10th the rain was accompanied by sharp lightning and loud thunder in the east. It was a characteristic thunderstorm.

*Toledo*—CHAS MASON: The best sleighing for years. Ground froze up very dry. The snow will not leave much water when melted.

*Thurman*—C. R. PAUL: A norther broke over this section of Iowa at 2:15 P. M., December 15, 1897. Strong wind accompanied by snow flurries and a rapid fall in temperature of 36° in six hours.

*Washta*—H. L. FELTER: On the 15th the thermometer fell from 30° above zero to 5° below in two and a half hours.

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### A NOTABLE HAILSTORM.

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A Washington county local paper gives some details of the destructive hailstorm that passed through that section September 1, 1897. It says:

On Friday we drove out into Highland township to see the track of destruction left by Wednesday's hailstorm. One could scarcely credit the reports that were current in regard to the damage done by it; but a drive through Highland township will soon convince the most skeptical that these reports are not exaggerated. We had no idea that anything short of a cyclone could do such fearful havoc in so brief a period.

Imagine, if you can, a tract of country at least sixty miles long and averaging two to three miles wide in which scarcely a stalk of corn is left standing and the crop is as complete and total a loss as if it had been cut with a corn harvester and stolen bodily from the owners. Imagine, if you can, a strip three to four miles wide on each side of this first strip in which, on an average, half the corn crop has been destroyed; put on top of this the wreckage of hundreds of windmills, the destruction of all the glass in the north windows of hundreds and hundreds of houses, the loss of thousands of chickens and turkeys, the wreckage of orchards, vineyards and gardens, the damage to barns, sheds, cribs, etc., and one will have a faint idea of the scene that meets the eye in the wake of the hailstorm.

At least 40,000 acres of corn have been totally destroyed, while 70,000 acres have been so pounded and wrecked by hail that half or more of the crop is a total loss. The



actual loss to the farmers in Washington and adjoining counties exceeds half a million dollars, and may pass the million mark.

Many farmers had shelled and hauled off their corn since the recent advance in the price, and by November 1st will not have a bushel of corn or a peck of apples to show for their season's work.

Driving northeast on the Riverside road, the damage became quite noticeable at Lyman Babcock's farm, and increased as we drove northeast and east. At the Foster farm less than a third of the corn was left standing, and two or three miles farther on it was scarcely possible to find a stalk standing in a forty-acre field. The stubs of the stalks stand, on an average, about two or two and one-half feet high, but the balance of stalks, ears, blades, etc., have been pounded off and are rotting on the ground. Wherever you find a willow hedge, the road is carpeted with leaves and twigs, and at a little distance the trees show just a shade of green and look as if they were just beginning to leaf out in the spring.

The storm seems to have originated in Iowa county, not far from Marengo, sweeping southeast through Iowa, a corner of Johnson, crossing the northeast corner of Washington and expending the remainder of its fury in Louisa county. It passed north of Wellman, but struck Kalona with full force, playing sad havoc with plate glass windows. The eastern edge just touched Riverside, the damage there being slight except by lightning. The St. Mary's parochial school building was struck and burned and is a total loss. The storm narrowed somewhat as it went south, and passed between Ainsworth and Otter.

At W. R. Jeffrey's farm, in Highland township, the storm became almost a cyclone and wrecked his fine new barn, 52x35 feet. Howard Jeffrey was in the barn at the time and had a close call. When the west end went out of the barn he tried to get into the basement, but failed, and just then was struck in the forehead with a hailstone and knocked senseless. Possibly this saved his life, for had he succeeded in getting into the basement he would have been crushed under the north wall, which was blown in bodily. This wall was two feet thick, seven and one-half feet high, fifty-two feet long and only three or four feet of it above ground.

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## WEATHER AT CLINTON, 1897.

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### ANNUAL REVIEW BY DR. LUKE ROBERTS.

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The following is the summary of the meteorological conditions which prevailed at Clinton for the year 1897.

The first five days of the year were cloudy and dark, with rain and mild temperature, but on the 6th the temperature dropped to 2° above zero. The fearful blizzard which had just traversed the Dakotas and Minnesota did not disturb eastern Iowa. From January 25th to the 29th the temperature was low, reaching 21° below zero on the 25th, with a clear sky and moderate wind. During this cold period a very severe blizzard was raging in Michigan. This cold wave extended southward to the gulf states. The average temperature of the month was above normal and the precipitation somewhat in excess with a snowfall of 7 inches.

February was colder than the average, and excessively cloudy with only 3 clear days.

The amount of precipitation was less than an average. Snowfall was 11 inches, but little valuable sleighing resulting.

This being the close of the winter months, the following departures from normal may be noted: Number of storm days, 4 less; depth of snowfall, 4 inches less; precipitation, rain and melted snow, .47 inches more; mean temperature, 3.2° more.

March gave a temperature much above normal; her winds were kindly tempered, but her rainfall came in excess. On the 19th 1.34 inches fell, and on the 23d occurred a notable storm of snow to the depth of 11 inches, which represented 1.36 inches of water. This snow did not remain long; being quite damp it clung tenaciously to every limb and twig, arching them beneath the accumulated weight. In the sunlight they resembled boros of crystals.

On the 21st the Mississippi river cleared of ice and a steamboat passed up. At the close of the month streams and wells were fully up to a normal condition for the season.

April was characterized by changeable temperature, but the mean was about normal.

The rainfall was .64 inches below normal, and yet from excess of wetness plowing and seeding had been retarded 10 days.

The river was at its season's height on the 18th, being 16.8 feet above low water.

May was largely deficient in rainfall, and, withal, rather cold. There were three frosts, the last one on the 31st, doing serious damage to potatoes, beans, tomatoes, strawberries, and early raspberries. Other fruits and vegetables, such as grapes and corn, were less injured.

The outlook at the close of the month was not very encouraging to farmers. Subsequent conditions proved their fears well founded, for the crops did not regain what was lost in the start.

June was more favorable for all kinds of crops, giving a normal temperature and a liberal amount of rain, but not up to the June standard. The deficiency of rain for the last three months, ending on June 30th, was 4.96 inches. A light frost appeared on the 7th.

From the 10th to the 19th, and the last three days of the month, it was very warm. An electrical storm on the 18th did damage to stock and buildings in the townships about. On the 30th a downpour of rain flooded a portion of Elk River township, overflowing the banks of the south fork of Elk river, inundating corn fields and grass.

July continued the hot days up to the 10th, beating the record for high temperature for so great a number of successive days.

Notwithstanding the excessive heat of July and the deficiency in rainfall, the crops thrived wonderfully. Matured crops, including hay, never gathered in finer condition. At the close of the month all growing crops and pastures were much in need of rain. Streams were low, except the Mississippi river, which was at a good stage of water up to the close of the month. But at the close of the following month the supply had been so diminished as to bring the water level down to 42 inches above low water mark. The August rainfall was a mere pittance, and the unharvested crops, pastures, trees and shrubs were seriously injured by the drouth and scorching rays of the sun. The first and last portions of the month were warm, and the central cool.

Except a copious rain on the 1st, September was no improvement over August. From the 2d to the 15th the temperature was high, and the number of clear days during the month was in excess of former records.

For the six months ended on the 30th day of September, only 11.25 inches of rain fell; being 10.49 below normal.

During the same period the mean temperature was  $65.1^{\circ}$ , while in 1881, with a temperature of  $65.7^{\circ}$ , there was a rainfall of 19.94 inches. The per cent of sunshine for the six months (1897) was 60, being 1 per cent above normal.

Notwithstanding the character of the weather for the season as narrated above, and the wetness and coolness of the soil at the time when early plowing and seeding is expected to be done, and the further fact that much of the early planted corn failed to come up, which necessitated replanting, the soil of Iowa made a record not to be ashamed of, in the yield of her varied grains and fruits for the year 1897.

The drouth continued to the close of October, with a large per cent of sunshine and high temperature, with less rainfall than in any former October, leaving pastures barren, and rendering plowing difficult.

During November the temperature kept above normal, and there was no excess of rain.

The only gratifying feature of the last two months was their fitness for all kinds of out-of-door work. The farmers appreciated this, and garnered their crops while the sun shone. The fine weather added to the quality of the corn crop.

December was colder than the average and deficient in rainfall, thus closing the year with less rainfall than any during the last nineteen preceding years. Total precipitation for the year was 23.63 inches, or 10.91 inches less than an average for the nineteen years. The lowest previous record was 27.57 inches, occurring in 1894.

The precipitation for the last ten years was less than the preceding nine years by 17.37 inches.

The dwellers in Iowa ought to be proud of her climate and soil when remunerative crops can be raised with a minimum amount of rainfall.

#### CONSPECTUS.

Highest temperature,  $100^{\circ}$ , June 14th and 17th.

Lowest temperature,  $21^{\circ}$  below zero, January 25th.

Extreme range of temperature,  $121^{\circ}$ .

Mean daily temperature,  $48.7^{\circ}$ .

Mean daily range of temperature,  $21^{\circ}$ .

Greatest mean monthly range of temperature,  $25.6^{\circ}$ , October.

Least mean monthly range of temperature,  $13.6^{\circ}$ , February.

Greatest daily range of temperature,  $47^{\circ}$ , October 1st.

Least daily range of temperature,  $5^{\circ}$ , April 5th.

Warmest month, July; mean temperature,  $76.1^{\circ}$ .

Coldest month, January;  $19.6^{\circ}$ .

Warmest day,  $87^{\circ}$ , July 3d.

Coldest day,  $14.7^{\circ}$  below zero, January 25th.

Total number of days with the maximum temperature of  $90^{\circ}$  or above, 41; 9 in June, 18 in July, 6 in August and 8 in September. The last three days of June and the first ten days of July were consecutively over  $89^{\circ}$ .

Total number of days with the maximum temperature  $32^{\circ}$  or below, 50; 17 in January, 7 in February, 3 in March, 5 in November, and 18 in December.

Total number of days with the minimum temperature at or below 32°, 135.

#### CLOUDS.

Mean daily cloudiness, 46 per cent of the surface of the sky.

Month with the greatest per cent of cloudiness, February, 71 per cent.

Month with the least per cent of cloudiness, September, 20 per cent.

Total number of clear days, 143.

Total number of cloudy days, 118.

Month with the greatest number of clear days, September, 23.

Month with the least number of clear days, February, 3.

Month with the greatest number of cloudy days, April, 19.

Month with the least number of cloudy days, July, 2.

#### PRECIPITATION.

Total depth of snowfall, 38 inches.

Greatest fall of snow at any one storm, 11 inches, March 23d.

Total precipitation (snow being melted), 23.63 inches.

Greatest rainfall at any one storm, 2.02 inches, June 23d.

Month with the greatest precipitation, March, 3.72 inches.

Month with the least precipitation, October, .27 inches.

Month with the greatest number of storm days, January, 12.

Month with the least number of storm days, October, 3.

Total number of storm days, 100.

The average rainfall per week was about .45 of an inch.

#### THE WIND.

Total movement of the wind, 42,290 miles.

Maximum velocity per hour, 32 miles.

Greatest monthly movement, 5,540 miles, March.

Least monthly movement, 1,600 miles, September.

Prevailing direction of the wind was from the west.

Observation taken at 7 A. M., 2 P. M. and 9 P. M. show the movement of the wind to have been 111 times from the north, 124 times from the northeast, 120 times from the east, 119 times from the southeast, 144 times from the south, 208 times from the west, 150 times from the northwest, and 119 times from the southwest.

Maximum velocity for January, 32 miles an hour; for February, 20 miles; for March, 26 miles; for April, 27 miles; for May, 20 miles; for June, 13 miles; for July, 32 miles; for August, 14 miles; for September, 12 miles; for October, 13 miles; for November, 23 miles; for December, 24 miles.

#### SNOW AND FROST.

The last spring snow fell on the 10th of April.

The first snow in autumn came on the 28th of November; depth, three-fourths of an inch.

Last killing frost in the spring, May 31st. It did much damage.

On the 20th of August a very light frost was seen in some low places, but the first damaging frost occurred on 21st of September.

Number of consecutive days without damaging frost, 113. This is the least number of consecutive days without damaging frost in 19 years, save that of 1883, which gave only 109. This was the year that corn was not permitted to mature on account of early frost. The season for growing crops was short and abnormally cool. The mean temperature for that year was 3° below normal.

The temperature of the air was at the freezing point for the last time in the spring, on the 20th day of April. The first in autumn, 29th day of October.

The last day in the spring when the mean temperature was below 32°, was March 27th, and the first in autumn was November 11th.

*Electro Meteors.*—Number of auroras observed, none. Number of days with thunner and lightning, 22. None in February, October and December.

*Optical Meteors.*—Number of solar haloes observed, 4; number of lunar haloes observed, 5; meteors, 1.

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## SIoux CITY WEATHER RECORDS FOR 1897.

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BY OBSERVER U. G. PURSELL.

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The weather in Sioux City for the year just passed, with the exception of the frequent winds, was of a rather commonplace order. There were hot days and cold days, and the rain fell and the snow dropped, but there was practically nothing extravagant or remarkable in their accomplishments. It might be said that 1897 was just an ordinary sort of a year as far as the weather was concerned, keeping well up with the average and not exerting itself to do anything to be wondered at, except that it blew itself a little bit more than its predecessors.

The hottest day of the year was July 31st, when the mercury stood on its tiptoes and peaked over the 102 mark. The hottest day Sioux City has seen since the weather bureau was established was July 24, 1896, when the mercury reached 107°. The coldest day of 1897 was January 25th, when the thermometer registered 18° below zero. The coldest day on record at the local weather office is January 19, 1892, when the temperature was down to 28° below zero. The mean annual temperature for 1897 was 46.8°. There were thirty-five days in the year when the mean temperature was below 14°; 110 days when it was below freezing point, 32°; 100 days when it was above 68°; thirty-four days when it was above 77°; not one when it was above 90°.

The total rainfall for the year was 20.38 inches, which is unusually light. The heaviest annual rainfall in Sioux City on record is 33.29 inches, in 1891. The heaviest monthly rainfall in 1897 was 4.03 inches, in April. The heaviest monthly rainfall on record is that of May, 1896, 6.39 inches. The lightest monthly rainfall in 1897 was .43 of an inch, in February. The lightest monthly rainfall on record was .02 of an inch, in December, 1895. The heaviest fall during any twenty-four hours in 1897 was 1.72 inches, on July

19th-20th. The total snowfall during the year was 47.9 inches. The heaviest monthly snowfall was in December, 26.4 inches

The 109,603 miles of wind was the only redeeming feature of 1897 in the way of sensations. Previous to this year 1894 held the record, with 102,069 miles. The largest monthly movement of the wind during 1897 was in April, 11,465 miles. The prevailing direction of the wind was from the northwest. The average hourly wind movement was 12.5 miles. The highest wind velocity was reached on June 18th, when the wind blew at the rate of 72 miles an hour. On only two occasions since the station has been established here has the wind reached a greater velocity, 84 miles on May 21, 1893, and 75 miles on June 20, 1894. On 24 days during the year did the wind blow a gale, that is, at a velocity of 40 miles an hour or more.

There were 99 rainy days during 1897; on 29 days it snowed; on 3 days it hailed; there were 15 foggy days; on 27 different days there were thunderstorms; there were no auroras borealis. There were 150 clear days, 78 partly cloudy days and 137 cloudy days. The average humidity of the air during the year was 82 per cent. The mean pressure of the air at 8 A. M., only one observation a day of the barometrical figures being taken, was 28.82; the highest pressure noted was 29.49, on February 26th; the lowest pressure noted was 28.14, on March 19th.

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## IOWA'S SOIL PRODUCTS.

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### REVIEW OF THE CROP SEASON.

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The crop season of 1897 opened unusually late, the necessary work of preparation for seeding and planting being begun ten days to two weeks later than in the average of recent years. The month of April was excessively wet, and the amount of sunshine was abnormally low. The soil was generally saturated with moisture, rendering field work difficult, and, as a result, plowing and seeding were greatly delayed or were performed under unfavorable conditions for the best results. May was cool and dry, and this caused the formation of clods and crusts on the surface of fields that had been worked during the wet period in April. Planting was done under unusual difficulties, and on account of the poor condition of the soil, cool weather, and defective seed, the stand of corn was much below the average. On the first of June the average condition of that crop was rated at 79 per cent, and the stand about 75 per cent. The crop correspondents of this service rated the other staple crops as follows: Winter wheat, 67 per cent; spring wheat, 91; oats, 88; barley, 86; rye, 90; flax, 89; timothy, 97; clover, 95; millet, 93; potatoes, 92; apples, 90; grapes, 85; strawberries, 96; meadows, 97; pastures, 99.

### JUNE.

As a whole the month of June was favorable to crop advancement, though some unseasonable weather prevailed during the first decade. The frost and freezing temperature on the last day of May caused but little per-

manent injury to field crops, but grapes and vegetables were badly hurt in exposed localities in the northern and central districts.

The first week in the month was colder than usual, and the rainfall was generally deficient. The cool weather continued until about the middle of the second week, followed by higher temperature, which brought up the average to about the normal. The dry weather throughout the first half of the month was favorable to replanting corn, which was necessitated by defective seed and the ravages of cut worms. Much more than the usual amount of replanting was done, and still the stand was far below the average of former seasons.

The third week brought seven abnormally warm days, the daily mean temperature ranging from 6° to 7° above the normal.

The rainfall was sufficient for the growing crops in the larger part of the state. Corn, wheat, oats, barley and flax made rapid advancement under the improved weather conditions.

The last week of the month was slightly cooler than usual, with copious showers throughout the larger part of the state. It was highly favorable for grass, potatoes, wheat, oats, barley and flax, and corn made some progress except where the soil had not been in condition to be cultivated. Haying operations were retarded by showery and cloudy weather. Oats were heading somewhat shorter than usual.

For the whole month the mean temperature of the air was slightly below normal, and the average rainfall was less than the seasonable amount.

At the close of the month the crop correspondents of the State Weather and Crop Service submitted their reports from the several counties of the state, showing average condition of crops as follows: Corn, 76 per cent; winter wheat, 61; spring wheat, 88; oats, 83; barley, 93; rye, 87; flax, 88; timothy, 89; clover, 89; millet, 100; broom corn, 82; potatoes, 92; sweet potatoes, 92; sorghum, 85; apples, 84; plums, 72; grapes, 80. The average decrease in the acreage of corn, compared with last year, is 6 per cent.

#### JULY.

The month of July brought weather conditions favorable to the seasonable advancement of growing crops, and also for harvesting matured soil products in excellent condition.

The temperature was slightly above normal, with an average amount of sunshine, and somewhat deficient rainfall in the larger part of the state.

The first decade was characterized by excessive heat and humidity of the air, affording tropical conditions for the rapid advancement of corn, potatoes, flax, and vegetables, and causing a tendency to rust in spring wheat, oats, and barley.

The weather during the second decade was cooler than usual, and generally dry, checking the development of rust, and affording favorable conditions for haying and harvesting. Corn made substantial progress, and was reported on the 20th to be in all stages of growth, from a foot high to size of tasseling and silking.

Moderate temperature and generally clear weather prevailed from the 20th to the 29th, during which time harvest work progressed under favorable conditions for securing the matured crops in the best possible order.



The month closed with a hot wave of considerable severity, causing much apprehension of damage to corn and other growing crops by hot winds and drouth.

At the central station, on the 31st, the temperature registered 98°, which was the maximum of the season up to that date. The close of the month brought numerous reports of the prevalence of drouthy conditions, which were especially severe in the southwest district. But there were relatively few reports of any serious actual damage to corn. The situation was described to be critical, and great damage would result if the drouth was protracted many days longer.

At the close of the month the harvest of hay and grain was practically completed, except that some late-seeded fields of oats and spring wheat remained to be cut in the northern districts. Good progress had been made in stacking grain, and threshers were in active operation in all districts, with varying results as to yield.

#### AUGUST.

The first decade of August was favorable for the development of all unharvested crops, the daily mean temperature being slightly above normal and in the larger part of the state refreshing showers and partly cloudy skies brought relief from the hot and drouthy weather of the latter part of July. Reports from weather-crop observers indicated that the early planted corn promised to reach maturity by the 20th to the 25th of September.

The second decade was cool and dry, retarding the growth of corn, and also unfavorable for grass and potatoes. Most of the days were bright and warm, but the temperature fell rapidly at nightfall, and on the morning of the 20th the frost line was reached at numerous localities, though no damage resulted except the severe check to vegetable growth. Numerous reports were received that corn on uplands and naturally light soil was being "fired" from effects of the prevalent drouthy conditions. The late corn and potatoes suffered most severe damage during this period. Pastures became bare and fall plowing was delayed.

The balance of the month brought measurable improvement in temperature, but the average was below normal and the rainfall was generally deficient. At the close of the month all sections were very deficient in moisture. The cool nights, however, afforded some relief from the prevailing drouth. On the last two days of the month the early planted corn began to show marked changes in color, indicating earlier maturity than had been anticipated. The pastures were generally brown, and where overstocked presented a bare appearance. Potatoes made but little growth and the outlook was not favorable for more than a half crop. The month was favorable for threshing and for harvesting wild hay, which has been secured in fine condition.

#### SEPTEMBER.

This month brought a marked change and the summary ending of a peculiar and fitful crop season. The first half broke all former records of September weather for the corresponding period, by abnormally high temperatures, intense insolation, hot southerly winds, and severe drouthy conditions. At the central station the sum of the excess in temperature was 228°



for the first 15 days, making a daily average of over 15° above normal. During 12 days the maximum temperature ranged from 90° to 98°.

The extreme heat and general aridity produced a notable effect upon immature crops, and all forms of vegetable life. Most of the early planted corn, which with normal temperature and moisture would have required two to four weeks to ripen in the best condition, was swiftly hurried to maturity, with more or less detriment to its quality. The transformation from milk and dough to the dented stage was too sudden to secure normal development of the grain. All corn planted betimes on deep, rich soil, well cultivated and possessing a good storage of moisture, came through with a fair average yield, and is but little impaired in quality. But the crop on exposed uplands, and on thin soils, generally suffered extensive damage by "firing" and premature drying up.

Frosts were noted in the northern districts on September 17th and 18th, and on the morning of the 20th a killing frost was reported in all districts. The bulk of the corn crop, however, was beyond the danger line, and probably less than 10 per cent was in condition to receive any appreciable injury from the frost. But potato vines and tender garden truck were cut down in all exposed localities. As a result of the dry weather, hot winds and early frosts, the potato yield has been greatly reduced everywhere, and in some sections the crop of late potatoes is well nigh a total failure.

The pastures and meadows have suffered the most damaging effects of the drouth and heat. Fall pasturage was almost wholly used up, and farm stock have been quite generally fed from the corn fields, or from the forage reserves provided for the winter season.

Fall plowing and sowing winter grain were retarded by the dry and hard condition of the soil, and the prospective acreage of winter wheat has been decreased thereby.

With all its drawbacks and abnormal conditions, however, the season of 1897 has brought forth liberal returns for the labors of faithful tillers of the soil. The final round-up will show that the state has produced a bountiful surplus for export to less favored regions.

## JUNE CROP REPORT.

FARM STATISTICS TABULATED FROM RETURNS OF TOWNSHIP ASSESSORS.

ACREAGE IN CROPS JUNE, 1897—LIVE STOCK JANUARY 1—LOSSES BY HOG CHOLERA IN 1896.

Complete returns have been received and tabulated of the farm statistics compiled by the township assessors; and with these figures as a basis we are enabled to present the crop acreage for the current season; also the number of live stock January 1, 1897, and the total losses by hog cholera in 1896. This report is especially valuable because it enables all classes to estimate the probable soil output of the season, and farmers may see the full scope and extent of their operations.

The acreage of winter wheat planted last fall appears to be 194,466 acres. The weather conditions during the winter and spring months were unusu-

# ACREAGE IN CROPS AND NUMBER OF LIVE STOCK, BY COUNTIES.

NAME	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352
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## SEPTEMBER CROP REPORT.

Reports from 565 crop correspondents of this bureau, for September 1st, have been received and tabulated. These reports were mostly mailed two or three days in advance of the 1st instant, and the estimates of the condition of corn and other crops were made before the culmination of the drouth in the form of hot and dry winds.

There is a wide range in the estimates as to the condition of the corn crop, compared with the average of past years. The average condition of corn for the state at large was estimated at 74 per cent of a normal crop. For the three southern districts the average was 70 per cent, and for the central and northern districts 76 per cent. □

This estimate was based upon the probable sequence of favorable weather, and that normal maturity would be reached by the 25th of September for the bulk of the crop. Many of the correspondents made explanatory statements, that the crop would be greatly reduced in condition and yield if the corn plants were killed by frost or extreme heat and drouth prior to the middle or latter part of September.

Other crops are rated as follows: Flax, 83 per cent; millet, 92; buckwheat, 85; broom corn, 86; potatoes, 55; grapes, 82; apples, 78; pastures, 82. The condition of potatoes, pastures and apples has been lowered since September 1st.

The reports of threshing indicate the following average yields per acre: Winter wheat, 13.6 bushels; spring wheat, 13 bushels; oats, 30 bushels; rye, 16 bushels; barley, 26 bushels; timothy, 3.9 bushels; cultivated hay, 1.5 tons per acre. These averages would indicate a total yield of winter and spring wheat, 15,996,208 bushels; oats, 132,173,460 bushels; barley, 14,348,542 bushels; rye, 3,619,168 bushels; cultivated hay, 3,239,000 tons. These figures are subject to revision in the final report, December 1st.

## FINAL CROP REPORT, 1897.

**AVERAGE PER ACRE, TOTAL YIELD AND FARM VALUES OF STAPLE PRODUCTS.**

Following is a summary of reports of correspondents of the Iowa Weather and Crop Service, giving the average yield by counties of the staple soil products of the past season; also the average prices paid at the stations nearest the farms, on December 1st.

The figures on the acreage of the various crops are based on the returns of township assessors, compiled and tabulated in this office in June, 1897.

FINAL CROP REPORT 1907 AVERAGE PER ACRE AND TOTAL YIELD BY COUNTIES

Monroe	7	21,189	15	230,133	21	1,115,769	25	395,000	11	39,814	29	116,730	35	19,250	1.1	31,350	440
Montgomery	15	40,950	15	11,593	28	2,603,779	31	685,775	16	14,133	23	116,730	35	51,800	1.5	19,763	8,760
Muscatine	12	53,410	14	375,800	34	2,336,519	33	770,583	14	44,430	23	931,728	43	79,630	1.3	36,686	2,767
O'Brien	...	...	10	352,030	27	1,839,839	23	1,576,233	8	6,580	23	72,960	65	98,605	1.1	10,285	9,350
Oceola	...	...	8	911,930	23	911,930	23	891,816	15	6,450	23	739,030	100	114,003	1.5	6,075	24,788
Page	16	113,280	13	103,945	23	3,651,433	36	732,233	17	13,345	29	6,119	47	90,616	1.6	44,920	7,062
Palo Alto	...	...	11	103,130	30	2,043,703	67	1,932,540	8	9,376	28	138,418	73	84,750	1.5	9,085	71,787
Plymouth	...	...	12	1,031,704	29	3,870,333	27	1,727,541	15	21,015	23	297,800	50	151,500	1.5	15,395	43,307
Pocahontas	...	...	15	160,875	27	2,037,123	29	1,617,910	15	14,935	25	146,475	60	102,240	1.7	8,891	79,477
Polk	20	11,340	16	104,530	23	2,880,773	39	1,124,710	18	27,493	20	1,730	43	192,780	1.6	35,742	12,938
Pottawattamie	10	9,590	15	652,850	30	6,304,330	35	1,753,715	18	36,793	21	64,722	40	155,600	1.8	45,054	32,495
Poweshiek	18	7,434	15	11,250	30	2,943,120	31	1,636,137	15	34,663	24	27,339	65	64,350	1.9	73,226	2,553
Ringgold	13	20,150	9	1,530	23	2,037,140	20	511,400	13	20,150	...	...	42	31,500	1.6	62,384	2,145
Sac	...	...	14	175,616	23	3,211,383	31	1,837,370	16	16,000	25	192,750	32	51,840	1.6	28,200	31,216
Scott	8	97,104	15	48,020	33	2,012,013	39	937,903	15	84,053	25	514,703	89	550,530	1.5	31,032	9,597
Shelby	10	2,500	13	374,330	30	8,333,280	35	1,291,095	19	23,030	25	253,000	83	183,600	1.5	29,430	10,490
Sioux	...	...	10	1,301,400	29	3,316,730	23	1,851,163	20	11,930	27	950,770	69	117,980	1.4	3,822	52,719
Story	...	...	16	50,922	31	3,211,510	33	1,814,040	15	83,630	20	15,800	45	52,300	1.5	28,554	34,620
Tama	18	10,930	14	78,416	32	2,954,530	31	1,917,745	18	54,504	27	536,353	46	72,630	1.7	51,403	17,052
Taylor	12	51,480	10	5,653	23	2,623,203	23	653,750	15	8,715	23	5,430	57	229,831	1.6	58,784	3,970
Union	16	5,880	15	3,720	23	1,593,763	23	518,883	14	13,033	...	...	25	34,300	1.6	43,152	1,118
Van Buren	7	63,714	5	725	27	1,207,038	20	299,003	9	14,310	...	...	55	23,650	1.3	21,732	...
Wapello	10	55,830	13	816	27	1,749,370	23	338,110	13	23,107	...	...	55	70,930	1.5	47,175	...
Warren	15	10,410	11	53,559	39	2,518,230	23	776,033	18	68,394	...	...	64	134,720	1.6	48,496	2,646
Washington	16	37,603	...	...	30	2,548,520	21	844,530	18	63,913	...	...	54	43,534	1.5	61,710	675
Wayne	10	11,200	...	...	23	1,672,670	23	469,374	11	23,830	...	...	36	61,920	1.4	67,748	689
Webster	...	...	15	65,175	23	2,816,788	23	1,837,610	20	37,630	22	103,810	53	95,150	1.8	14,886	76,690
Winnebago	...	...	10	165,930	23	991,795	24	892,234	12	1,533	23	124,743	80	48,900	1.5	5,604	50,193
Winneshiek	15	753	17	81,603	33	2,251,570	29	2,082,630	11	29,338	25	340,475	68	90,120	1.5	51,181	10,337
Woodbury	10	1,510	13	513,849	25	4,256,750	27	1,080,732	10	24,363	20	94,400	45	108,450	1.5	13,995	47,496
Worth	...	...	11	61,405	26	993,513	33	1,704,450	16	13,472	23	288,250	84	71,400	1.6	17,788	27,718
Wright	...	...	15	90,810	27	2,314,710	30	1,932,330	20	6,703	24	103,010	46	44,620	1.4	16,500	45,008
Total yield.	13	1,671,454	13.4	12,911,603	29	239,452,150	30	132,271,153	15	3,490,344	25	14,076,856	60	10,051,919	1.6	3,362,287	1,939,117
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Great care has been exercised to make a reliable computation of the acreage harvested and total yield by counties, and the result is believed to be approximately correct.

*Wheat.*—The average yield of winter wheat is 13 bushels per acre, and the total product of the state is 1,671,454 bushels. The average per acre of spring wheat is 13 bushels, and the total amount harvested is 12,941,600 bushels. These figures show a total wheat output of 14,613,054 bushels. Average price at farms, 74 cents per bushel.

*Corn.*—The reports show a variable output of this great staple, the average yield by counties ranging from 22 to 35 bushels per acre. The state average is 29 bushels per acre, estimated on the acreage actually harvested, which is from 3 to 7 per cent less than the area planted; the reduction resulting from unfavorable conditions in the season of planting and cultivation. The acreage planted was 8,610,145 acres; loss by various causes, 356,623 acres, leaving 8,253,522 acres as the area harvested. The total yield for the state is found to be 239,452,150 bushels, all of which is dry and sound. While the result is somewhat below the Iowa average, yet the output of merchantable corn is fully 60,000,000 bushels in excess of the amount that appeared to be possible to obtain in the early part of September. The phenomenally dry and warm weather of the fall months brought to maturity a large portion of the late planted fields that would have been wholly unmerchantable if normal conditions had prevailed. The average price is 17 cents per bushel.

*Oats.*—Average per acre, 30 bushels; total yield, 132,571,155 bushels; average farm price, 16 cents per bushel.

*Rye.*—Average yield per acre, 15 bushels; total product, 3,490,344 bushels; farm price, 34 cents per bushel.

*Barley.*—Average per acre, 25 bushels; total yield, 14,076,856 bushels; price at farms, 23 cents per bushel.

*Flax.*—Average per acre, 10 bushels; total yield, 2,498,600 bushels; price, 87 cents per bushel.

*Potatoes.*—Average yield per acre, 60 bushels; total yield, 10,051,919 bushels; average farm price, 45 cents per bushel.

*Cultivated Hay.*—Average yield per acre, 1.6 tons; total yield, 3,362,287 tons; farm price, \$4.50 per ton.

*Wild Hay.*—Average yield, 1.3 tons per acre; total yield, 1,939,117 tons; farm price, \$3.70 per ton.

*Buckwheat.*—Average yield per acre, 13 bushels; total yield, 224,120 bushels; average price, 51 cents per bushel.

*Timothy Seed.*—Average yield, 3.5 bushels per acre; total yield (estimated) 785,000 bushels; average farm price, \$1.10 per bushel.

*Clover Seed.*—Average yield per acre, 1.8 bushels; yield (on estimated acreage), 105,000 bushels; average farm price, \$2.80 per bushel.

*Millet Seed.*—Product estimated, 125,000 bushels; average price, 33 cents per bushel.

*Sweet Potatoes.*—Bushels produced (estimated), 225,000; price per bushel, 90 cents.

*Sorghum.*—Estimated value, \$375,000.

*Broom Corn.*—Estimated value, \$35,000.

*Vegetables and Fruit.*—Estimated value, \$5,500,000.

*Corn Fodder.*—In field and shock, worth \$9,500,000.

*Pasturage.*—Value estimated, \$28,000,000.

The average farm price of horses appears to be \$42 per head; cows, \$33 per head; wool averaged 15 cents per pound. The amount of fall plowing is placed at 65 per cent of the average.

Despite the floods of spring, and the severe drouth of the latter part of summer and the fall, the season has been fairly productive; and the enhanced prices have brought an increased prosperity to the producers. The corn crop, though about 75,000,000 bushels short of the total yield in 1896, is worth materially more in feeding value and for storage. About 60 per cent is of full weight and very sound; the balance is shrunken more or less by premature ripening, but the crop as a whole is much better than was anticipated.

#### GENERAL CROP SUMMARY—1897.

PRODUCTS.	Yield per acre.	TOTAL PROD- UCT.	FARM VALUE DEC. 1.
Wheat .....	18		\$ 10,812,859
Corn .....	26	1	40,706,895
Oats .....	30	1	21,211,204
Rye .....	15		1,188,716
Barley .....	25		2,237,679
Flax .....	10		2,172,789
Potatoes .....	60		4,622,208
Cultivated hay .....	1.6		15,120,291
Wild hay .....	1.3		7,174,728
Buckwheat .....	12		114,251
Timothy seed .....	2.5		892,200
Clover seed .....	1.8		294,000
Millet seed .....			41,250
Sweet potatoes .....			202,200
Borghum .....			875,000
Broom corn .....			25,000
Fruit and vegetables .....			5,500,000
Corn fodder .....			2,800,000
Pasturage .....			28,000,000
Total .....			\$151,084,899

A large increment in value is gained by the consumption of these soil products on the farms, in the production of beef, pork, mutton, wool, dairy goods, poultry, horses, etc. As finally marketed the staple crops of this state usually bring 30 to 50 per cent above the average prices current at the farms at the close of the season. The soil output of 1897 will yield over \$200,000,000 to the farmers of Iowa.

### LOSSES BY SWINE DISEASE.

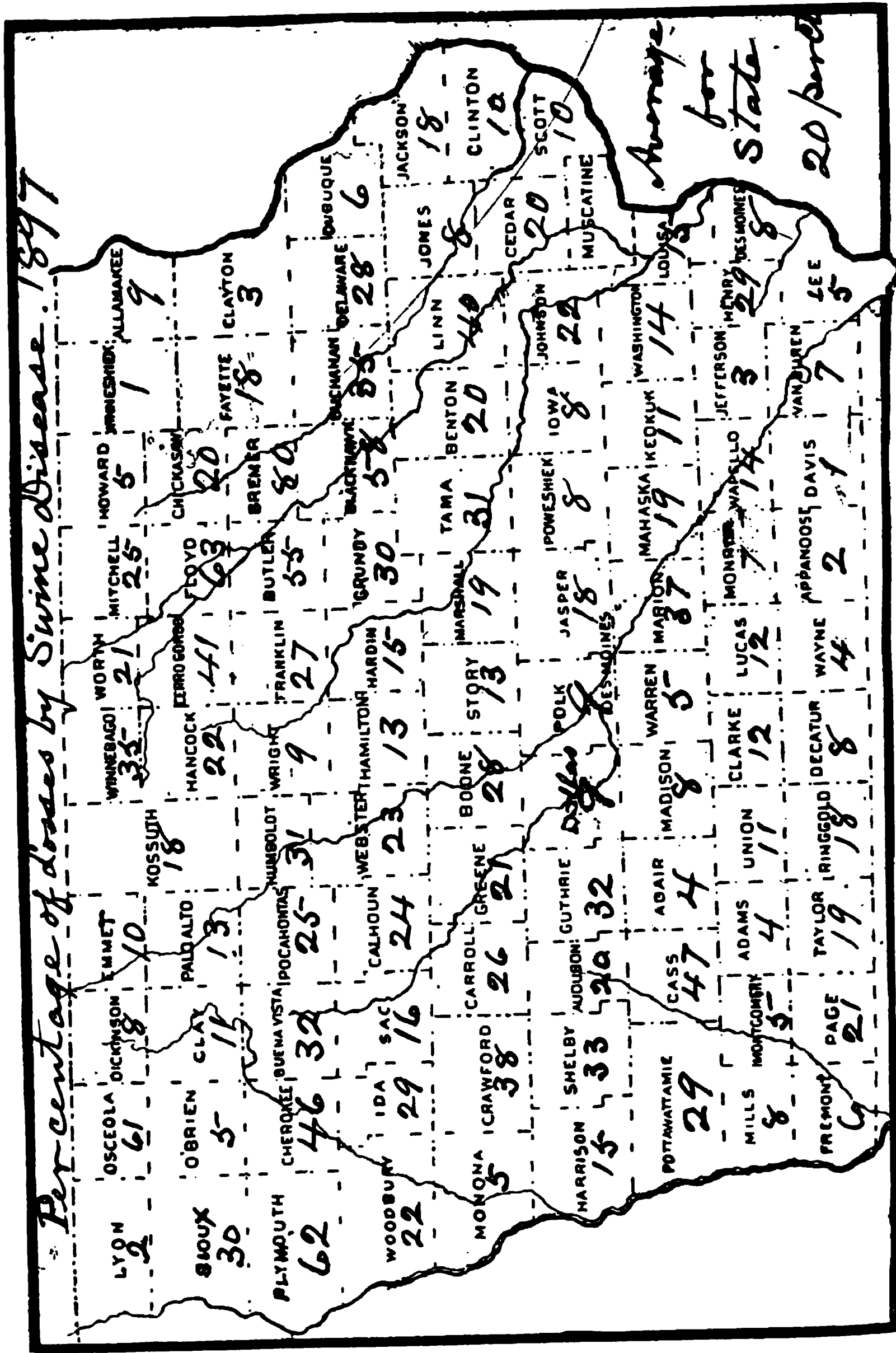
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The crop correspondents of this bureau were asked to report the approximate percentage of loss of hogs by cholera or other disease, for the current season to December 1st. The reports have been tabulated by counties, and the estimates are shown on the engraved chart in this issue. The state average appears to be about 20 per cent. This shows a decline in the virulence of the epidemic compared with 1896.

Many correspondents state that the returns do not indicate the total losses to the farmers, many of whom shipped off their herds of all ages and stages of growth as soon as the epidemic appeared in their vicinity.

It is probable that the losses will aggregate about two-thirds of the total last year. Expressed in cash values, the direct and indirect losses will amount to fully \$10,000,000.





## WEATHER-CROP BULLETINS.

SUMMARIES OF WEEKLY BULLETINS ISSUED DURING THE CROP SEASON  
OF 1897.

## BULLETIN NO. 1, APRIL 6TH.

The past winter brought more than the normal amount of precipitation, and the spring has been unusually wet, with less than the normal amount of drying winds and sunshine. As a result, the streams, sloughs and ponds have been filled to overflowing, the soil is thoroughly saturated, the roads are well nigh impassable, and field work has been generally impracticable.

The season is ten days to two weeks late in all districts. A few reports show that a beginning was made in seeding wheat and plowing grass lands prior to the heavy rains of April 1st to 4th. It will now require several days of drying weather to put the soil in condition for field work. The rains have brought out the frost in all sections except the northern districts. The conditions have been favorable for grass, which has made a fair start.

Generally unfavorable reports are received from districts where fall wheat has been sown. The plants appear to have been winter-killed to more than the usual extent. Fall rye has fared somewhat better. Grass has wintered fairly well, except in low ground, where it has been covered with ice and water.

With seasonable warmth and drying weather in the near future, the agricultural conditions will be rapidly improved.

## BULLETIN NO. 2, APRIL 13TH.

The past week was unseasonably cold, with excessive cloudiness. The daily mean temperature ranged from 5° to 7° below the normal. But the precipitation was generally light, and a moderate improvement is reported in the condition of the soil.

Reports from all districts show that a beginning has been made in sowing wheat, oats and barley, though in many cases the soil was not in good condition to secure the best results. In the southern districts some early potatoes have been planted.

The week closes with unsettled weather, and conditions not wholly encouraging to farmers who are waiting for the drying out of their water-soaked lands. The season is at least two weeks later than the average, and the delay in seeding will most likely cause a decrease in the prospective acreage of small grain crops.

Fruit buds, except peaches, appear to be all right.

## BULLETIN NO. 3, APRIL 20TH.

There was a continuance of cold weather during the larger part of the past week, but the rainfall was generally light, and there was more sunshine and drying wind. The daily mean temperature was from 5° to 7° below normal. The heaviest rainfall was reported in the northeast and east central districts. Since the 15th inst. the conditions have been generally more favorable for farming operations, and substantial progress in seeding has been made in all parts of the state.

In the three northern districts a good beginning has been made in sowing wheat, oats and barley, and the work is being rapidly pushed. In the central belt seeding is over half done on the average, the work being hindered only on the wet and undrained lands. In the southern belt the work is further advanced, except where the land is naturally very retentive of moisture.

On the whole farming prospects are materially improved, though the season is fully two weeks late in respect to seeding and germination.

Grass has made a good start, the wet and cool weather giving a substantial foundation for a large crop.

## BULLETIN NO. 4, APRIL 27TH.

The first of the week was unseasonably cold, with frost, ice and sleet. This was followed by much higher temperature, making the average for the week about normal.

The rainfall was phenomenally heavy in the central and southern districts, the amounts reported ranging from 2.50 to 6.70 inches. The average for the whole state during the week was more than the normal amount for the month of April. All former records of April precipitation in this state have been broken. The week brought a culmination of the bad weather of this most unfavorable season.

As a result all farm operations have been delayed and very little progress has been made in finishing up seeding and making preparations for planting. In some sections reports show that from 30 to 50 per cent of the area set apart for oats has not been seeded. There will be a decreased acreage of oats on this account.

There are no reports of damage resulting from the freezing temperature on the 19th and 20th. Fruit of all kinds appears to have escaped any serious injury. Grass is growing rapidly, and early sown spring wheat and oats are doing notably well. With the close of the week the weather conditions appear much more encouraging.

## BULLETIN NO. 5, MAY 4TH.

The first half of the past week was warm, and the latter part unseasonably cool, the temperature reaching the freezing point. But the rainfall was generally light, and there has been a decided improvement in weather conditions as affecting farm work and the growth of vegetation. So far as can be learned at this time no material damage was caused by frost.

Good progress has been made in seeding, and in preparing the ground for planting where the soil is dry enough for field work. Greater advancement has been made in the northern districts than in the southern half of

the state where the rainfall has been much heavier. In the southern and central districts, a considerable acreage of land intended for wheat, oats and barley will be planted to corn or other crops. And a large area of bottom lands that were cultivated during the recent dry seasons will not be in condition to be farmed this year.

Grass has generally made seasonable growth, and pastures now afford considerable feed for stock. The prospects for hay are unusually good.

[BULLETIN NO. 6, MAY 11TH.

The daily mean temperature during the past week ranged from 5° to 7° above the normal, and the average amount of sunshine was fully 95 per cent. On the evening of the 8th timely showers, fairly well distributed, benefited the crops and put the soil in better condition by softening the clods and the encrusted surface.

The fine weather in the first decade of the month has advanced vegetation rapidly toward the normal stage of growth, and has been highly favorable to rapid progress in field work. A very large area has been prepared for corn, and reports from all districts indicate that a good beginning has been made in planting, and the work is now being rapidly pushed to completion. With a continuance of the present favorable conditions the bulk of the corn acreage will be planted about as early as in the average of the past ten years.

Spring wheat, oats and barley are generally doing fairly well, the chief drawback being a tendency of the soil to bake in fields where the ground was too wet when seeded.

Plum, cherry and apple trees are in full bloom, and small fruit is promising. Pasturage is fine. Potatoes and garden truck are generally planted.

BULLETIN NO. 7, MAY 18TH.

The past week was unseasonably cool, with a prevalence of northwest winds and less than the normal amount of sunshine. The average temperature was from 3° to 5° below normal. There were light frosts in all districts, but no material damage has been observed. The rainfall was generally light; and in the northwest section warm showers would be beneficial to all crops.

Fair progress has been made in preparing the ground for planting; and in all districts a considerable area has been planted, the amount ranging from one-third to three-fourths of the total acreage. With favoring conditions the bulk of the planting will be completed by the 22d. Reports indicate a probable corn acreage very nearly as great as that of 1896.

The condition of spring wheat, oats and barley is generally satisfactory, though the growth has been retarded somewhat by cold winds. Grass is doing well. Apples, plums, cherries and small fruit are quite promising.

BULLETIN NO. 8, MAY 25TH.

Weather conditions during the past week were quite variable. The daily mean temperature the first half of the week was above normal, and the latter half unseasonably cool, the temperature falling dangerously near the frost line. On the 19th and 20th local showers of considerable

severity occurred in portions of the central and northern districts. The average rainfall for the state, however, was below the normal amount. Fair progress has been made in corn planting, and the work is nearing completion in the larger part of the state. In localities where plowing was retarded by wet condition of the soil planting will not be completed before June 1st. Early planted corn is generally making a good stand, and the work of cultivation is in progress. Not more than the usual amount of replanting is necessitated by defective seed.

In portions of the central and southern districts oats and spring wheat are somewhat injured by the encrusted condition of the soil. Warm rains are needed for grain and grass in many localities.

On the whole, however, the crop prospects are fairly promising. Cherries, plums, apples and berries are apparently doing well.

#### BULLETIN NO. 9, JUNE 1ST.

The past week was unseasonably cold and cloudy. The deficiency in temperature at the central station was  $37^{\circ}$ , and the daily mean ranged from  $5^{\circ}$  to  $7^{\circ}$  below normal throughout the state. The amount of sunshine was from 50 to 70 per cent. Light frosts are reported from numerous localities, but the damage has been slight. The rainfall was generally light and insufficient for the needs of the crops; but portions of the east central and southern districts received copious showers which were very beneficial.

Corn planting is practically completed, and cultivation is general. Variable reports are received as to the stand secured, but the average condition appears to be below the normal of that crop. The amount of replanting made necessary by defective seed and depredation of worms is much greater than early reports indicated. In many sections the amount of replanting will be from 25 to 33 per cent of the total corn acreage.

The average condition of oats, spring wheat and barley is good except in portions of the southern districts. The cool weather has been favorable for grass and small grain crops. Fruit is generally promising.

#### BULLETIN NO. 10, JUNE 8TH.

The week opened with a frost of considerable severity in the northern and central districts, and this was followed by seven days of unseasonably cool weather, the daily mean temperature being from  $6^{\circ}$  to  $7^{\circ}$  below normal. The amount of rainfall was generally deficient.

The worst effects of the freezing temperature of May 31st have been observed in fruit and vegetable gardens. Grapes were severely hurt, especially in the northern districts. All tender vines and plants in the northern half of the state were damaged to some extent.

The injury to field crops by the frost has not been as great as was indicated by first reports. But the continued cold weather has been unfavorable to corn, causing increased difficulty in procuring a good stand from seed that was deficient in vitality. A great deal of replanting has been done, and with the most favorable weather conditions in the future the stand will be below an average. The reports of 700 crop correspondents of the state service, made June 1st, rated the condition of corn at 79 per cent. The crop has only been able to take root and hold its ground since that date.

Oats, spring wheat, barley and grass are doing fairly well in the larger part of the state. Spring seeding of timothy and clover shows up remarkably well.

Just at this time there are no alarming indications of an over production of the staple crops of the country.

BULLETIN NO. 11, JUNE 15TH.

The first half of the week was cool and the last half warm, giving an average of about normal temperature. There was also a seasonable amount of sunshine. The rainfall, in the form of light and scattering showers, was generally below the seasonable amount, and much short of the requirements of all crops.

Corn has responded quickly to the influence of warm weather, showing a better color and more vigor. Wherever a good stand has been secured the condition of the crop is fairly good, though the plant is small for the middle of June. Vigorous attempts have been made to improve the stand by replanting, and in numerous cases it has been necessary to go over the fields the third time. At the best the condition of the crop in this respect will be 10 to 20 per cent below the average. Fair progress has been made in cleaning out the crop.

In four-fifths of the state the surface is too dry for the best advancement of small grain and hay, though no great injury has yet resulted from the lack of rain. The pastures and meadows are showing some effects of dry weather, and rain is needed, especially to sprout the seed in replanted corn fields.

Clover cutting will be commenced within the coming week.

BULLETIN NO. 12, JUNE 22D.

The past week brought seven abnormally warm days, the daily average temperature being from 6° to 7° above the normal. For nine consecutive days at the central station the daily temperature has been from 2° to 12° in excess, making a period of phenomenal heat for the month of June.

The rainfall has been unusually variable, coming in the form of local showers, some of them accompanied by severe wind squalls and considerable electric force. The amount of moisture is sufficient for present needs in about three-fifths of the area of the state; the balance is suffering to some extent from protracted dry weather.

All reports indicate that corn has made rapid advancement wherever it has received good culture and the soil conditions are favorable. The chief drawback to this crop is that the stand is generally below the average, and this can not be fully remedied. The color is good, but the plants are generally below the seasonable height and normal condition.

Wheat, oats, barley and grass are doing fairly well in the larger part of the state. In all districts, clover haying is in progress. Potato bugs and other insects are more than usually troublesome.

BULLETIN NO. 13, JUNE 29TH.

The past week was slightly cooler than usual, the average daily deficiency being about 2°. The rainfall was generally ample, the northwest

district receiving the least amount. Heavy local showers occurred in the central and southern districts, and some damage resulted from wind and hail.

On the whole the week was favorable for grass, potatoes, wheat, oats and barley; and with some local exceptions corn has made fair progress. The condition of the corn crop is extremely variable, ranging in height from two inches to two feet. Some of the more advanced fields will be laid by before the 4th, and others are now being cultivated the first time, with a close race between corn and weeds. The average stand in the state is not above 80 per cent.

Haying operations have been retarded by showery and cloudy weather. Oats are heading short, and the crop cannot give a normal yield. The most promising cereal crops in the state are spring wheat and barley, with a large increase in the acreage of wheat.

BULLETIN NO. 14, JULY 6TH.

The average daily temperature of the past week was 3° to 5° above normal, and the heat was unusually oppressive on account of excessive humidity of the air. The rainfall, in the form of light showers, was generally less than the seasonable amount, but some portions of the southern district received a considerable excess, making the soil too wet to cultivate the corn fields.

The week has been very favorable for the growth of pasturage, potatoes, flax and garden truck, and for corn that has been properly cultivated. Corn has made fine progress except where cultivation has been hindered by excess of moisture. In all districts early planted fields are being laid by. Hay making is in progress, but the work has been materially hindered by light showers and cloudiness. Spring wheat is generally filling well, and no reports are received of damage by rust or insects. Oats and barley are improving.

The July reports of the crop correspondents of the State Weather and Crop Service have been tabulated, showing the average condition of crops to be as follows: Corn, 76 per cent; winter wheat, 61; spring wheat, 88; oats, 83; barley, 93; rye, 87; flax, 88; timothy, 89; clover, 89; millet, 100; broom corn, 82; potatoes, 92; sweet potatoes, 92; sorghum, 85; apples, 84; plums, 72; grapes, 80. The average decrease in the acreage of corn, compared with last year, is 6 per cent.

BULLETIN NO. 15, JULY 13TH.

The past week brought five days of unseasonably high temperature, which were followed by two days of cooler weather with refreshing showers. The amount of rainfall was variable, but nearly all sections received sufficient moisture for present needs. The showers on the 9th were heavy in some localities, with brisk winds, causing heavy grain and hay to lodge to some extent; but on the whole the rains were very beneficial to all crops.

The heat and humidity gave the corn crop a wonderful growth, and no damage resulted from hot winds. This crop is now generally laid by, in variable condition as to size, stand and freedom from weeds. The early planted corn is coming into tassel, at fair height; and the general reports indicate about three-fourths of an average crop.



The hot and moist weather was somewhat unfavorable to spring wheat and oats, which are now at the stage to receive injury by rust and blight. Reports indicate the appearance of rust in numerous sections, but the cooler weather has checked its progress, and the extent of damage may not be as great as has been anticipated.

Barley and rye are being harvested, and some early sown oats will be cut within the coming week. Satisfactory progress has been made in securing the hay crop. Pastures are excellent. Potatoes are doing better.

BULLETIN NO. 16, JULY 20TH.

The past week was cooler than usual, with less than the normal rainfall except in a few localities. The deficiency in the daily mean temperature was from 5° to 7°. The amount of sunshine was about normal.

It was an ideal week for field work, and has been improved to the utmost. Good progress has been made in the hay harvest, and a large amount is secured in excellent condition. Rye is in shock, and barley is being harvested. A good start has been made in cutting early oats.

The weather conditions have been highly favorable for spring wheat, checking the tendency to rust and favoring the filling and ripening. The bulk of this important crop is in fair condition, and the total acreage this season is above 1,000,000 acres.

Corn has made substantial progress wherever it has received good cultivation. It is in all stages of growth, from a foot high to the tasseling size. The acreage planted is very large, being about 8,600,000 acres, and in about two-thirds of that area it gives promise of a fair crop, with favorable weather for the balance of the season.

We are just now in the midst of the usual midsummer dry weather period, and rain is generally needed for all growing crops, especially potatoes.

BULLETIN NO. 17, JULY 27TH.

This has been a week of fine growing weather. The temperature was generally seasonable, and except a few scattered localities all parts of the state have been copiously watered. Some damage resulted from severe local wind and electric storms, on the night of the 23d.

The rains were timely, and especially beneficial to corn, potatoes, pastures, blackberries and garden vegetables. Early corn is doing notably well, and generally there is sufficient moisture to carry it safely through the tasseling and earing stage. Belated corn is doing its best, under varying conditions as to tillage and freedom from weeds.

Fair progress has been made in the harvest fields. The hay crop has been mostly secured, and the larger part of the oats crop is in shock or stack. The harvest of spring wheat is in progress, and the bulk of the crop will be in shock or stack before August 1st. Some reports have been received of injury to wheat by rust or scab, but the extent of damages can only be determined by threshing returns. The average condition is not likely to be reduced below previous estimates.

Threshing operations begun in barley, oats and winter wheat.



## BULLETIN NO. 18, AUGUST 3D.

The week was unseasonably warm, with much less than normal rainfall except in a few favored localities. The greatest excess of temperature was registered on the last two days of the week, causing some apprehension of damage to crops by hot winds; but a change of wind direction and lower temperature on the night of August 1st relieved anxiety on that score.

The week was favorable for work in the harvest fields, and satisfactory progress has been made. The harvest of oats and spring wheat is completed, except late seeded fields in the northern districts. A good deal of stacking has been done, and threshers are at work in all sections, with varying results as to yield.

The harvest season as a whole has been much more favorable than last year, and the bulk of hay and grain has been secured in excellent condition.

Corn has made fairly good progress during the week, and substantial gains during July. Reports received from the larger number of crop correspondents of this bureau show the average condition of corn on August 1st to be 80.5 per cent, as against 76 per cent July 1st.

## BULLETIN NO. 19, AUGUST 10TH.

The weather during the past week was favorable for all growing crops. The daily mean temperature was slightly above normal, and refreshing showers, with partly cloudy skies, brought relief from drouthy conditions in all districts. In the larger part of the state the supply of moisture is ample for all present needs, and complaints of injury by drouth are heard from only a few scattered localities.

Corn has made fine progress in all sections. Variable replies have been received from crop observers to the inquiry in relation to the length of time required under normal conditions to mature the corn crop and place it beyond danger of harm by killing frosts. The larger number report that early planted corn will be practically safe about the 15th to 20th of September. Late planted fields, that were well tilled, may be fairly matured by October 1st. An unknown percentage of the crop will need warm, drying weather through the first ten days of October to make merchantable corn. It is highly probable that more than the usual amount, at the rear of the procession, will be cut off prematurely by killing frosts.

Threshing is in progress, and reports are showing fair to good yields of wheat, oats and barley. Potatoes and pastures have been helped by the showers.

The August 1st reports of crop correspondents show the following averages of the unharvested crops: Corn, 80.5 per cent; millet, 93; flax, 84.5; buckwheat, acreage 96 and condition 92; broom corn, 83; sorghum, 88; potatoes, 74; apples, 75; grapes, 82; pastures, 92.

## BULLETIN NO. 20, AUGUST 17TH.

The week has been cool and the rainfall deficient in the larger part of the state.

The average daily deficiency in temperature ranged from 2° to 4°. There was more than the usual amount of sunshine, however, which made the days sufficiently warm to promote the ripening of crops.

The west and southwest districts received the larger quantities of rainfall, and some of it came in sections where the need of moisture was greatest. But the bulk of the state needs a good soaking rain, followed by warm weather, to bring forward the beated corn and potatoes and revive the pastures.

The cornfields in the northern half of the state are not as yet suffering materially from lack of moisture. they show a deep, green color, and no signs of being "fired." Some of the early fields in that section would ripen without more rainfall. But the late planted fields in all sections need more moisture, and warm weather till October 1st, and some more warmth after that to ripen up thoroughly.

Potatoes and pastures need more rain, in copious supplies. The outlook for the potato crop is very unpromising.

Threshing is in progress, and more than the usual amount of grain has been stacked.

#### BULLETIN NO. 21, AUGUST 24TH.

The week was unseasonably cold, the average daily temperature being 8° to 10° below the normal. Some of the days were warm and bright, but the temperature fell threateningly at nightfall, and on the early morning of the 20th it dropped to the frost line in numerous localities, but no damage resulted beyond retarding the ripening crops.

The prevailing drouthy condition was mitigated by showers in small portions of the state, but rain is much needed for grass, potatoes, late corn, and to put the soil in condition for fall plowing.

Corn is doing as well as could be expected under present conditions. In sections where the drouth has been most severe the dry, upland fields are badly "fired," the stalks are dwarfed, and the general condition of the crop is poor. The early planted corn is generally in full roasting ear, and most of it will reach fair maturity by the 20th of September, with normal weather. But the balance, comprising 50 to 60 per cent of the acreage planted, needs rain, followed by warm, ripening weather throughout the month of September; and at the best it will fall materially short of an average crop. The situation is critical, but with a normal September the bulk of what has been grown may be secured.

A fair start has been made in fall plowing, and harvesting wild hay is in progress.

#### BULLETIN NO. 22, AUGUST 31ST.

The average temperature of the week was about normal, the days being bright and warm and the nights cool. The rainfall was deficient, except in a few localities, and the drouth is unbroken over the larger part of the state; the central and southern districts have suffered the worst effects of the prevailing dry weather.

The effect upon the corn crop has been to hasten the ripening of early planting, and check the growth of late corn, which needs both warmth and moisture for its normal development. On dry uplands the leaves are being fired, and the yield will be materially reduced. In a few localities the early planted fields are being cut to secure the fodder in the best condition. With the present weather conditions about 50 per cent of the crop will be

fairly ripened, and safe from damage by frost, by September 20th; the balance will need all of September to mature, with normal weather.

Pastures are becoming dry, and the drouth is damaging to late potatoes.

BULLETIN NO. 23, SEPTEMBER 7TH.

The past week brought a notable change from the cool weather prevalent through the larger part of August. At the central station, since the 31st, the daily temperature has been 13° above the seasonable average, the maximum on five successive days ranging from 96° to 98°, and at some other stations 100° were registered. It has broken the record of high temperatures in the month of September in this section. And during this period brisk southerly winds prevailed with a very low percentage of humidity.

In the larger part of the state there was but little more than a trace of rainfall; local showers of considerable severity, with high winds, visited portions of the east central, northeast and north central districts, affording partial relief from the prevalent drouth.

The effects of the hot, dry winds are noted in all sections. The further development of belated corn has been checked, and its chief value will be in the fodder that may be secured. Much of the early planted corn which, with normal temperature and moisture, would have required from two to four weeks to ripen in the best condition, has been swiftly hurried to maturity. It remains to be seen how much shrinkage will be caused by this sudden transformation from milk and dough to the hardened, dented stage of ripeness. But unquestionably it would be materially better in quality of grain to ripen more slowly, under normal conditions.

It is better thus, however, than the opposite extreme. By excessive heat and dryness much of the corn crop has been saved from the destructive effects of a killing frost; "Saved, yet so as by fire." And those who cut their corn will thereby secure the larger measure of the feeding value of the crop.

The drouth has seriously affected the potato crop and pastures, and in some sections cattle are being fed from the forage reserves.

BULLETIN NO. 24, SEPTEMBER 14TH.

The weather conditions of the preceding week were continued through the past seven days, with slight mitigation by scattered showers on the 10th and 11th insts. Twelve consecutive days with maximum temperature about 90° in the larger part of the state, make a new record for September in this region. This average daily excess of 12° to 14°, intensified by brisk to high south winds, a low percentage of humidity, and general absence of rainfall, has swiftly ripened the larger portion of early planted corn, but with some detriment to its quality. The late corn on dry upland has been dried up and made worthless except for fodder. A portion of the belated crop, on deep rich soil, and well cultivated, is still growing and will mature under normal conditions within the coming two weeks. Unquestionably the abnormal heat and drouth have materially shortened the possible yield of corn, which at the outset was deficient in stand.

The drouth has been especially damaging to pasturage and the potato crop. Plowing and fall seeding have been greatly retarded.

## BULLETIN NO 25, SEPTEMBER 21ST.

The first half of the week ending the 20th was excessively warm, and the latter part much cooler than usual, making an average slightly above normal. Frosts were noted in the northern districts on the mornings of the 17th and 18th; and a severe frost occurred on the morning of the 20th in all districts.

The extent of damage resulting from these frosts cannot be estimated at this time; it is probable that late corn, potatoes and garden vegetables have been extensively cut down in all exposed localities.

Most of the corn, however, was beyond danger of harm, and it is probable that not more than 10 per cent of the crop was in condition to be materially injured by the frosts that have thus far visited the state.

The severe drouth was broken by copious showers well distributed over the state except portions of the western districts.

Plowing has been resumed and pastures are greatly benefited by the rains.

The dry weather and hot winds of the first half of September damaged winter apples quite extensively.

## BULLETIN NO. 26, SEPTEMBER 28TH.

The past week has been dry, slightly warmer than usual, and almost wholly cloudless throughout the state. It has been ideal weather for ripening and drying out the corn crop, which will be in condition for the crib within ten days, if dry weather is protracted.

Variable reports are received as to the damaging effect of the recent severe frosts on the late planted corn. The extent of injury will be more clearly revealed by the scales, after the crop is harvested. There can be no question, however, of the statement that the crop would have been sounder and better in quality if it had ripened under normal conditions.

As a whole the corn crop is remarkably large and sound in view of the fact that the season was exceedingly unfavorable during the time of planting and cultivating, and since that time the temperature has been fitful and intermittent. Probably 60 per cent of the total yield will be sound and merchantable, and the balance will possess considerable feeding value. The round-up of the season will show that the soil products of the state have been abundant and greatly in excess of home requirements.

The dry weather has greatly reduced pasturage, and necessitated early feeding of stock. It has also retarded plowing and seeding of fall grain.

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LOCAL CLIMATIC CHANGES.

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MONTHLY REVIEW U. S. WEATHER BUREAU.

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A correspondent in Northfield, Mass., desires our opinion on the question: "Were the winters of fifty years ago much colder, or were the snowfalls deeper than at present? The opinion is widely held that the winters were colder and the snowfalls deeper, but I can find nothing to warrant the belief except that in the first part of the century a much larger percentage

of the population lived in the hill towns or in the interior, which are both colder than the valley or the coast towns."

On the general question as to the appreciable changes in climate the editor's opinion is that there has been no such change in any respect whatever so far as meteorology proper is concerned. If we divide our records of the weather recorded in North America since the days of Columbus, into two periods, viz., before and after the year 1800, we shall find that every peculiarity, such as remarkable storms, winds, rains, floods, frosts, etc., recorded in the current century, can be matched by a corresponding remarkable event before the year 1800. The popular impressions alluded to by our correspondent result almost entirely from the imperfections of our records and especially of our memories. There is a large class of persons whose habits of thought are so crude that when they experience any very remarkable weather they jump to the conclusion that the climate has changed, forgetting that they themselves have had such a limited personal experience that they are not fair judges of the weather over the whole country or of the climate of a century.

Our correspondent seems to suggest that a certain change in the habits of the people, such as the removal from the interior to the coast, or from forests to prairies, or from country to city, or *vice versa*, will partly account for widespread errors in respect to climate. The suggestion is excellent, but the editor would be inclined to interpret the phenomenon somewhat differently. The general movement of the population in the past century has been from the Atlantic states westward, and from the country to the city, or quite opposite to the movement suggested by our correspondent. In fact, we find no real agreement in the so-called popular traditions with regard to the weather. We have met with quite as many persons who think the winters are more severe as with those who think the winters are less severe than formerly. Everything seems to depend upon how and where the "oldest inhabitant" lived when he was a boy as compared with his present condition. If he moved from a farm on a windy hilltop in the country down to a cosy house in the village, the climate seemed to him to have improved. If he moved from the milder climates on the coast in his youth to the severer climates in the interior he was, as a boy, struck with the great change, and the impression still remains with him that those winters were severer than now. If he has lived continuously in a large city like New York, where the growth of tall houses, the increased smoke, and diminished sunshine have completely changed the climate, and where these combined with the changes in the mode of living, especially the abolition of the open wood fire, have rendered the human system vastly more sensitive, he finds that the inequalities of climate are greater than formerly.

From a hygienic point of view "the climate" includes everything that affects the health and comfort of the body. The meteorological climate that agrees perfectly with one person may be entirely too severe for another. Our remembrance of our physical sensations is not a safe criterion when judging of climate. Our remembrance of an occasional storm or winter is not a safe guide in comparing the past with the present. Our records of deep snows are too fragmentary to give anything more than a general conviction that there has been no material change in the snowfall.

Our records of extreme low temperatures are liable to be in error several degrees by the ancient use of very imperfect thermometers, and are almost certain to be exaggerated if the thermometers were placed in valleys or lowlands where cold air settles on still, clear nights, so that we must use great caution in interpreting these records; differences of 5°, 10°, and even 20° have occurred between the minimum temperatures recorded by weather bureau and voluntary observers located within a few miles of each, owing to the combination of these two sources of error.

Remarkable rains and snows are usually quite local phenomena; there have been several remarkable cases of this nature in certain portions of New England and the middle Atlantic states within the past ten years. Similar remarkable cases occurred in other portions of these states fifty years ago, and equally remarkable cases occurred in still other portions just before 1800. If there has been any change in the climate of Northfield, Mass., it is because it lay within some one of these regions of extraordinary rain or snow on one occasion and not on another. Such a change of climate at one spot is no criterion by which to judge of changes at other places 100 miles away. The average climate of New England, so far as the weather is concerned, has not appreciably changed since the days when her oldest forest trees were young saplings, and that carries us back nearly 500 years.

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### THE FORMATION OF DEW.

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The following extract is from an article written by Dr. J. G. McPherson, lecturer on meteorology in the University of St. Andrews, published in the Wakefield (Eng.) *Express*:

Whence comes the dew? It does not fall from the air. Whence comes it, then? We shall see. Ground a little below the surface is always warmer than the air over it. As long, then, as the surface of the ground is above the dew point, vapor must rise and pass from the land into the air. The moist air so formed will mingle with the air above it, and its moisture will be condensed, forming dew wherever it comes in contact with a surface cooled below the dew point. In fact, dew rises from the ground.

Place some metal trays over the grass, the soil, and the road on dewy nights. You will generally find more moisture on the grass inside the trays than outside; you will always observe a deposit of dew inside the trays, even when there is none outside at all. This shows that far more vapor rises out of the ground during the night than condenses as dew on the grass and other objects.

Pieces of iron lying on grass are soon surrounded with richer grass, on account of the moisture which the cold metal attracts from the rising water-vapor. Travelers in Australia and South Africa state that they often found the under side of their bedding placed on the ground to be wet after camping out at night. I remember, when walking in the vicinity of Hexham with an acute observer, trained to farming, that, on my remarking that the farmers might to their profit remove the extraordinary quantity of small stones from the fields in order to give room for the growth of the grain, he shrewdly said: "These stones collect moisture from the ground;



the soil is thin, with a gravelly subsoil, and unless the maximum amount of moisture be collected (which can only be done by allowing these stones to remain), there would be a very deficient crop. They must not, therefore, be removed."

Dew, then, rises from the ground. But how is the dew formed on bodies high up in the air? If the dew comes out of the ground, should it not be found on bodies only exposed to the earth? Now dew does not rise in particles, as it was once considered to fall in particles like fine rain. It rises in vapor. Some is caught by what is on the surface of the earth, but the rest ascends in vapor form until it comes in contact with a much colder surface, to condense it into moisture. The vapor does not flow upward in a uniform stream, but is mixed in the air by eddies and wind currents, and carried to bodies far from where it rose. In fact, dew may be deposited, even though the country for many miles all around be dry and incapable of yielding any vapor. In such cases the supply of vapor to form that dew would depend on the evaporation of the dew, and on what was wafted over by the winds.

But the most practically convincing proof of the rising of dew from the ground is in the form of hoar frost or frozen dew. If it has been a bright, clear, sunny day in January, with no snow on the ground, look over the garden, grass and walks on the morning after the intense cold of the night; big leaves may be found scattered over the place. You see little or no hoar frost on the upper surface of the leaves, but turn up the surface next the earth, or the road, or the grass, and what will you see? You have only to handle the leaf in this way to be highly astonished. A thick, white coating of hoar frost, as thick as a layer of snow, is on the under surface. Leaf after leaf will present the same appearance. If a number of leaves have been overlapping each other, then there will be no coating under the top leaves; but when you reach the lowest layer, next the bare ground, you will find the hoar frost on the under surface of the leaves. Now that is positive proof that the hoar frost has not fallen from the air, but has risen from the earth. And hoar frost is, as we have said, frozen dew.

Dew, then, mostly rises from the ground, and what used to be thought dew is the active exudation of the healthy grass. These two facts are now established. Brilliant globules are produced by the vital action of the plant, showing life in one of the most charming forms in the phenomena of nature.

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## VALUE OF LONG CONTINUED METEOROLOGICAL RECORDS.

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Great interest attaches to a long continued meteorological record by any one observer. A station whose record runs back twenty-five years becomes a medium of comparison for all the surrounding territory, and one of fifty years establishes the normal values for that section of country. On the other hand, one must be careful not to draw too many fine conclusions from any one such record, for in the course of fifty years barometers deteriorate and thermometers change their scale of corrections, to say nothing of the breakages and renewals that will happen to every instrument. Even the

simple rain gauge is liable to be changed, and especially do its records suffer from the fact that the growth of trees and shrubbery, the erection of buildings, and possible changes of location, such as are almost sure to be made when the observer thinks he can improve the exposure — all contribute greatly to change the catch of the rain gauge. These inevitable changes increase the difficulty of ascertaining whether there has been any secular variation in climate. Such variation, if any, is certainly always very small and usually far less important than the variations due to the changes in instruments and their exposures. Although, therefore, the continuity of a record by one observer at the same station for a long period is partially broken up by these changes, still there is always a feeling that his ancient and his recent records are more comparable among themselves than would be the case with records made by different observers at different locations in his neighborhood. There is, moreover, a great advantage in having long records of cloudiness, direction and force of wind, the number of rainy days, the direction of the clouds, frequency of thunderstorms and auroras, and other miscellaneous phenomena not generally recorded by means of instruments and in reference to which the habits are, therefore, most important. \* \* \* It would be a valuable contribution to climatology if our voluntary observers and the directors of the state weather services would acquaint themselves with the locations in their neighborhood where temperature and rainfall records have been previously kept and would stimulate or provide for the renewal of those records for a period of time long enough to establish clearly the relation between the climates at those spots and at the neighboring locations where records are kept. — *Monthly Weather Review, U. S. Weather Bureau.*

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### CLIMATE AND HEALTH.

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Under this heading some of the aspects of medical climatology are discussed by Dr. Charles Fayette Taylor in the *Popular Science Monthly* for July, 1895.

Change of climate and its attendant circumstances, even when not of any extreme character or degree, do produce an impression, more or less profound, on the vital processes, and physicians, when consulted, should have some definite advice to give in regard to locations best suited to the inquirer's special needs, or, at least, ought to be able to give their patients some very positive ideas as to the kind of climate to seek, and especially what to avoid. For instance, California is 770 miles long and embraces a number of distinctly different climates. What, then, is the use of telling a patient with a hole in the top of his lungs to "go to California," without telling him where to locate, where he should go, or what kind of a climate he should look for? To know the mean temperature of a place, and to know only that, is to know very little about its climate.

The physiologic effects of climate include the degrees of humidity, the force and direction of the prevailing winds, the sunshine, cloudiness and fogs and other unmeasurable influences, not seen, though felt.

The thermometer in the interior valleys of California has been seen to indicate 100° to 110° for days together, and no one complained of the heat



as excessive and heat prostrations were unknown. In New York, when the summer heat approaches 90°, prostrations occur and sometimes deaths. This is not to show that 110° heat in California, with no prostrations, is a better climate than New York, with 90° and many prostrations, but to illustrate the principle that we must know more about climate than what the thermometer can tell us. From the fact that fewer microbes were found in the dry air of high altitudes it must not be too hastily concluded that the higher and drier locality was essentially more healthful than the lower and moister locality, even for consumption, until we know the quality and energy of other meteorologic influences. People in those high regions have a thin and tired look, and it is found useful and often necessary to visit the lower and damper localities in order to recuperate.

It seems that climatology has heretofore, to a large extent, resolved itself into a search for some place where consumptives can not die. There is no such place. There is no climate where the ever-present bacillus may not get in its deadly work.

The chief question in climatology in its relations to health should be: "In what climate, or by what changes and influences of different climates, can we be best invigorated for good existence in the location where we are obliged to live the greater portion of our lives?" It is amazing to see people, intelligent about ordinary things, traveling for their health at a rate that suggests that they have been shot out of a gun. Some do, of course, find limited benefit, but often mistake change of feeling due to excitement for recuperation. Instead of rushing across the face of the earth in the delusive hope of finding health on the other side, we need to learn how to sit down and make ourselves comfortable where we are. A protest is entered against the practice of sending patients, often far gone with consumption or other diseases, away from friends and comforts of home, without knowledge of what would be the best for them, in a fruitless search for health, when in their enfeebled states better conditions could be instituted at home, where at least they could die in peace. When the medical profession fully realizes the immense value of climate in therapeutics a climatology may be formulated which shall be of great value to the healing art.

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### THE CHINCH BUG.

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DAVID H. CARR, U. S. WEATHER BUREAU, MILWAUKEE, WIS

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This insect, known to scientists as the *Blissus Leucopterus*, first made its appearance in North America in 1783, and at that time was thought to be a species of the Hessian fly, which had first made its appearance in this country a short time before. When full grown the chinch bug is about one-seventh of an inch in length; black, with white upper wings marked by two well-defined black spots. The young vary in color from a pale yellow to a bright red and the pupa is reddish brown and wingless. The female deposits her eggs under the ground in clusters near or upon the stems or roots of wheat, corn, oats or grasses. Sometimes on pulling up a wheat plant hundreds of eggs may be seen adhering to the roots, where the

mother insect has placed them. The young remain in or near the earth, sucking the sap from the stems or roots of the plant. It is while in the larval state that these insects do most damage, sometimes destroying half the crops of a district. After maturing they ascend the stalks of the plants and infest the stalks and leaves in great numbers, generally during the early part of June. Fortunately the larva is killed by moisture, so that a rainy season is of great benefit in destroying them before they are sufficiently matured to produce young in their turn. In drouths, however, the chinch bug increases with fearful rapidity, and although the insect feeds chiefly upon wheat, it does not disdain other vegetation, and in fact, as an aggrieved farmer said, "nothing comes amiss to it." It seems, however, to prefer wheat, corn, barley, oats and grasses in the order named. It has no mandibles, but is equipped with a tiny apparatus for piercing the stalks and leaves, and sucks out the juice, thus destroying the plant in a short time. The insects sometimes appear in armies, moving in solid columns from field to field, traveling along the ground and destroying nearly everything in their path. It is owing to the fact that while on these migrations the chinch bug makes very little use of its wings that it has been classed in the *Hemiptera* or half-winged order, in which the metamorphosis from the wingless to the winged state is incomplete. The chinch bug hibernates during the winter, hidden away within the leaf sheaths of corn stalks in shocks of corn, in the crevices of fences, or under the shelter of any kind of rubbish affording protection from the rain. This insect is not affected by cold, instances being known where it was found frozen, and on being thawed out immediately resumed its activity. It quickly succumbs to moisture, however, and where irrigation is practiced, flooding fields for several days in succession will generally dispose of the pests. Two broods of these insects appear in this section of the country during the season, the first in June and the second in autumn. The disgusting bedbug-like odor of both the young and the adult insects appears to protect them from most insect-eating birds and predaceous insects. They are, however, eaten to some extent by the quail and probably by a few other birds; among insects, the lady-bird beetle destroys them in considerable numbers. They are also subject to attacks of bacterial diseases, which are the most potent factors in reducing their numbers.

Following are several suggestions which have proven practicable in dealing with these pests:

All rubbish accumulated along fences and headlands should be hauled into the fields in the autumn and burned. Spraying with kerosene emulsion, using the force pump and cyclone nozzle, kills the bugs without injury to the crops and is undoubtedly the best remedy in the hands of the farmer. Infested grass and grain lands should be burned over during the fall and winter and all rubbish destroyed that offers protection from the rain. If piles of straw are left at convenient places and burned during the winter the result will be a decided decrease in the number of chinch bugs. It is also a good plan to burn the stubble, old straw, and weeds in fence corners in the early spring. When on migrations their progress may be checked by spreading a thin layer of coal tar across their path.

In the future serious depredations by the chinch bug will be prevented by propagating among them the bacterial forms of disease peculiar to the

species, which spread very rapidly among them and under which they quickly succumb.

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## THE ORIGIN OF THE WEATHER BUREAU.

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PROF. CLEVELAND ABBE.

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The writer well remembers the day when, as a youth, over forty years ago, he visited Merriam, "the Sage of Brooklyn Heights," whose publications had awakened his attention to the possibility of publishing reliable daily weather predictions.

In those days the New York evening papers printed a daily weather bulletin, furnished by the enterprise of the telegraph companies, which gave the temperature, wind and weather for some early morning hour at a large number of stations scattered over the whole country. Had these items been displayed graphically upon a map of the country, it would have been possible to practice daily forecasting for New York; but as this was not done by the newspapers, the readers picked out only a few interesting temperatures as items of news, and never realized how nearly they had in their grasp the power of predicting the weather. But I suspect that this daily charting is precisely what Merriam may have privately done, and on which he may have based his occasional public predictions of "heated terms" and "cold terms."

If those telegrams had contained the readings of the barometer in addition to the other items, and if Merriam had charted them, as Espy and Henry were then doing, he would undoubtedly have been able to add also the prediction of storm winds and rain. If Merriam's manuscripts are still in existence, they would afford valuable material for a history of meteorology in America. An old scrapbook of mine, begun in the year 1851, still reminds me of my vivid interest in the prediction of the weather by rational methods. It was not until ten years later that I realized that this daily telegraphic bulletin in the New York newspapers was directly due to Prof. Joseph Henry, who in 1849 had asked that these weather items be telegraphed for the use of the Smithsonian Institution, in order that he and Espy might study the origin, development and progress of American storms. From 1842 to 1857 James P. Espy was the official meteorologist of the United States, and carried on his work in co-operation with the army, the navy and the Smithsonian.

No man ever had a broader appreciation of science for its own sake, and also of science as a means of benefiting mankind, than Prof. Joseph Henry, the noble-hearted first secretary and organizer of the Smithsonian. His natural gifts and his scientific researches were well known before he was elevated to this position, of whose duties and responsibilities he entertained the most exalted conception, and to which he was faith'ul to the last.

There is scarcely a branch of practical or applied science that he was not able to advance; among these telegraphy and meteorology, with their applications to the benefit of mankind, stand pre-eminent. In 1848, Redfield, of New York; Loomis, then of the Western Reserve college at Hudson, Ohio, and Espy, of Philadelphia, were the leaders in the study of storms.

Henry was the friend of all, and indorsed and advanced their views. The telegraph companies, recognizing and acknowledging their indebtedness to him for his discoveries and inventions in electrical matters, granted him freely those daily weather dispatches that he asked for and which enabled him to be the first to demonstrate systematically the truth that Redfield, Espy and Loomis had long maintained; *i. e.*, that through the telegraph, although then in its infancy, we had the power to predict the coming storms. The Morse telegraph line was open for public business in April, 1845, and in 1846 Redfield published his conviction of the probable value of the telegraph and the daily chart; it is on record that merchants in New York, Boston and Cincinnati, in their individual capacities, were often guided by weather reports telegraphed from a few neighboring stations. But systematic and public work for the benefit of all was the object that Henry had in view. To this end a daily telegraph bulletin was compiled at his request, and was communicated both to the Smithsonian and to the daily press. To this end he immediately displayed this same data daily on a map at the Smithsonian institution. To this end he constantly interviewed members of congress as to the propriety and the necessity of a public weather service, illustrating his talk by actual predictions for Washington. To this end, finally, in 1864, he was preparing to revive his map, which had been temporarily discontinued during the war, when a disastrous fire in the Smithsonian building checked all further work in this direction. But Henry's agitation of the importance of the subject did not cease, as is shown by the testimony of several members of congress whom he interested in the subject. Meanwhile, England, Holland and France had awakened to the possibilities of the case.

Owing to the labor of Espy, Redfield, Loomis and Henry, there was widespread throughout this country a conviction that something useful could be done in the way of weather predictions. When the writer proposed the subject in May, 1868, first to the trustees of the Cincinnati observatory, then to Mr. John A. Gano, as editor of the Cincinnati Commercial, subsequently again to him as president of the chamber of commerce, there was an immediate response to the effect that "this is what we have long been doing for our individual business interests and will be glad to have you do for the city as a whole." When, in August, 1869, on behalf of Cincinnati, he made a similar proposition to the Chicago board of trade, looking to co-operation, there was a temporary difficulty in accepting it; but an editorial in the Chicago Evening Journal called public attention to the nature and importance of the work, and the weather bulletin of the Cincinnati observatory began September 1, 1869. When in December, 1869, Prof. I. A. Lapham's memorial to the academy of sciences was, by the Hon. E. D. Holtan, converted into a memorial to the national board of trade, and by the Hon. H. E. Paine into a memorial to the senate and house of representatives at Washington, there was from each an immediate favorable response. Professor Henry was at hand to say that from a scientific point of view the scheme was thoroughly sound; the representatives from Ohio were at hand to say that the work was being successfully done in Cincinnati; General Myer was on hand to say that the army signal corps were ready to carry out the practical part of the great national work. Thus Mr. Paine's bill was rapidly forwarded through the various stages of legislation, and the act of February 4, 1870, accomplished the great object

that had been held steadily in view for forty years by Henry and his co-laborers—a national weather bureau was established; another department of science was recognized as of eminent utility.

During the past twenty-seven years the American public, and for that matter the world at large, has with increasing admiration viewed the energy, the accuracy and the practical value of the work of the weather bureau. Those who admire climatology as well as those theoretical students who deal with the difficult mechanical problems involved in meteorology have sometimes felt that the bureau pays too little attention to scientific investigations, and that many nice points are lost sight of in the breadth of the work and the rapidity of execution that has always been imposed on us by the public and by our successive chiefs.

But, whatever reason there may have been for this criticism, it is likely to be removed if the plans of our present chief are allowed to come to full fruition. The fact is that the meteorology, considered as the scientific study of the laws of atmospheric phenomena, is not yet in a perfectly satisfactory position. This is not to be wondered at when we recall that, in 1870, Ferrel was the only man who possessed clear views of the mechanical problems involved in the movements of the winds.

His work was broad and general, and it was necessary to collect more facts before attempting any future developments in unraveling the mechanics of the atmosphere. Since those days our knowledge of the laws of mechanics and thermodynamics, as applied to the air, have been advanced by the study of skillful mathematicians and physicists. Simultaneously with their work, the publication of daily weather charts, and the exploration of the air by means of high mountain observatories and by balloons and kites and the spectroscope, has given us such a solid observational basis that we can now begin to handle the problems of nature in a manner that promises partially to satisfy the demands of exact science.

If our universities would give dynamic meteorology a prominent place in their courses of study, it would greatly facilitate our future progress and the development of a new race of students. In the matter of observations the most desirable improvement is the invention of some method by which to ascertain the actual condition of the air as to pressure, temperature and moisture at a considerable height above the ground. When Professor Moore shall be able to realize his ideal of obtaining, at any moment, the wind and temperature from any altitude up to two miles by means of kites or other devices, we hope to have a satisfactory solution of this problem, and shall be able to apply the recent development of mechanical ideas to comprehensive studies of atmosphere.

PRECIPITATION DATA.

Average monthly and annual precipitation (rain or melted snow) at various Iowa stations for the period of years named.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.	No. years.	Record is in- cluded be- tween dates be- low.
Albion.....	.91	1.89	2.17	2.04	4.18	5.11	4.14	3.02	4.40	3.17	1.84	1.18	34.45	6	1879-1894
Algona.....	.66	.74	1.66	4.19	3.19	3.41	2.87	2.35	1.92	1.45	1.01	1.45	24.40	6	1892-1897
Amara.....	1.53	1.28	1.97	2.93	4.21	4.56	4.18	3.44	3.34	2.63	1.77	1.48	33.31	23	1875-1897
Ames.....	1.07	.93	1.42	2.91	4.02	4.26	4.61	3.40	3.53	2.21	1.22	.99	30.65	23	1875-1897
Alta.....	.80	.74	1.95	4.19	4.12	5.64	3.78	3.51	2.15	2.17	.95	1.08	31.08	7	1891-1897
Atlantic.....	.67	.88	1.83	3.68	4.28	5.44	3.71	2.95	2.81	2.20	.70	1.41	30.56	7	1891-1897
Audubon.....	.64	.84	1.92	4.53	3.39	3.37	3.13	3.54	3.32	1.79	1.77	1.13	29.40	5	1893-1897
Blakeville.....	2.23	1.58	2.07	2.54	5.25	6.19	3.74	3.47	1.94	4.30	1.76	3.46	38.63	4	1890-1898
Belle Plaine.....	1.53	1.10	2.08	3.45	3.86	3.53	3.30	2.43	2.38	2.34	1.60	1.47	29.17	8	1890-1897
Bonaparte.....	1.79	1.02	2.51	3.81	3.70	3.61	3.83	2.78	3.98	1.20	2.02	1.83	32.08	7	1891-1897
Brookside.....	1.43	1.67	2.43	2.99	4.83	5.78	5.97	5.29	4.60	3.62	2.24	1.26	42.20	16	1892-1879
Brookville.....	1.26	1.26	1.99	3.06	3.83	4.97	2.82	3.29	3.00	2.95	1.77	1.62	31.92	11	1876-1898
Carroll.....	1.23	1.08	2.54	4.15	4.20	4.32	3.30	2.84	1.87	2.57	1.06	1.04	30.30	8	1890-1897
Cedar Falls.....	1.09	.94	1.43	3.72	4.77	3.58	4.82	2.65	3.17	2.26	1.29	1.32	31.04	7	1891-1897
Cedar Rapids.....	1.64	1.54	2.80	3.20	4.55	3.93	3.02	2.88	2.93	2.65	1.55	1.70	31.79	16	1883-1897
Centerville.....	1.48	1.18	1.95	5.02	2.98	3.58	5.88	3.13	2.36	.83	1.52	3.12	33.03	5	1892-1897
Charles City.....	1.37	1.13	1.53	3.61	3.68	5.26	2.74	2.38	2.44	1.72	1.32	1.62	28.83	7	1891-1897
Clarinda.....	1.06	.93	1.83	3.42	4.53	5.31	4.31	3.62	1.68	1.78	.88	1.20	30.54	8	1890-1897
Clinton.....	1.94	1.59	2.18	3.14	4.09	4.32	3.54	2.06	3.01	1.25	2.07	1.29	30.43	7	1891-1897
College Springs.....	.50	.89	1.88	4.31	4.51	4.45	5.75	2.82	1.96	2.61	.80	1.59	32.07	7	1891-1897
Corning.....	.70	.76	1.87	3.87	4.74	4.20	4.32	3.33	2.09	2.60	.84	1.07	29.29	6	1892-1897
Oresco.....	1.29	.93	1.31	2.58	3.60	5.27	3.94	2.95	3.71	2.29	1.42	1.33	30.62	27	1871-1897
Davenport.....	1.78	1.62	2.23	2.95	4.39	4.36	3.86	3.59	3.27	2.59	2.07	1.37	34.07	26	1871-1897
Delaware.....	1.19	.74	1.77	3.04	3.98	4.09	3.56	2.94	3.34	2.08	1.77	1.81	30.31	7	1891-1897
Decorah.....	1.37	.60	1.20	3.50	3.04	4.72	2.26	1.26	3.15	2.15	1.43	1.45	26.13	5	1892-1897
Denmark.....	1.46	1.98	2.23	2.53	4.47	5.85	3.33	3.52	2.80	3.32	1.87	1.94	35.89	12	.....
Des Moines.....	1.34	1.23	1.51	3.06	4.67	5.10	3.84	3.30	3.14	2.92	1.55	1.43	32.98	20	1878-1897
Dubuque.....	1.68	1.48	2.24	3.02	4.06	4.99	4.42	3.04	4.15	2.63	2.04	1.81	35.56	25	1878-1897
Dysart.....	1.33	1.18	1.74	2.22	3.92	4.96	4.75	3.80	4.75	3.08	1.75	1.68	35.08	13	1877-1889
Elkader.....	1.53	1.10	1.73	2.98	3.74	3.94	4.14	2.98	3.98	2.63	1.71	2.28	32.69	19	1879-1897
Fairfield.....	1.61	1.41	2.06	3.08	6.01	4.30	3.24	3.63	2.71	2.60	1.99	1.73	24.23	13	1879-1897
Fayette.....	1.41	.92	2.06	3.59	4.06	6.42	3.00	3.61	2.95	2.61	1.63	1.63	28.94	8	1890-1897



PRECIPITATION DATA—CONTINUED.

STATIONS.	No. Years.												Record is in- cluded be- tween dates be- low.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Garnaville.....	1.03	1.11	1.28	2.00	3.25	3.72	5.27	3.29	4.55	3.21	1.08	1.06	30.85
Galva.....	.49	.31	1.38	3.94	3.07	3.76	3.42	2.90	2.05	1.14	1.04	.87	24.37
Glenwood.....	.84	.75	1.38	2.50	5.21	4.46	3.56	3.52	2.18	2.44	.92	.85	28.61
Grand Meadow.....	1.54	.90	2.00	3.69	4.14	5.56	3.59	2.47	3.02	3.24	1.52	1.76	32.43
Greenfield.....	1.02	1.08	2.51	3.84	4.23	4.17	4.70	2.81	3.11	1.61	.95	1.60	31.61
Grinnell.....	1.19	.77	2.00	3.66	4.60	5.08	2.87	3.82	2.03	2.14	1.49	1.37	31.02
Grundy Center.....	.58	.69	1.37	4.30	4.24	3.60	4.11	2.74	2.79	2.33	.98	1.40	29.13
Guttenburg.....	1.14	1.17	1.88	2.33	3.55	5.17	4.62	3.61	3.87	2.34	2.01	1.89	23.58
Hamlin.....	.57	.56	.85	1.56	3.31	3.49	3.84	2.88	2.55	2.59	.85	.84	23.89
Hampton.....	1.25	1.12	1.96	4.36	3.70	4.97	3.56	2.74	2.84	2.50	1.70	1.46	22.16
Hawkeye.....	1.95	1.24	2.25	3.12	3.56	4.61	2.38	2.55	2.67	1.46	1.46	1.72	28.97
Hopeville.....	2.43	.84	1.75	4.14	4.66	3.93	4.45	3.11	2.95	1.67	.90	1.13	31.96
Hopkinton.....	1.58	1.30	1.99	2.63	4.25	1.20	3.67	3.97	4.68	3.56	2.09	1.88	32.80
Humboldt.....	.56	.48	1.47	4.64	3.36	3.20	3.53	2.20	2.16	1.59	.90	.72	24.83
Ida Grove.....	.82	1.00	.84	1.64	3.85	5.14	3.71	3.14	3.84	2.70	1.00	.94	28.62
Independence.....	1.28	1.03	1.74	2.46	4.01	4.80	4.38	3.16	4.36	2.30	1.41	1.41	32.34
Indianola.....	1.17	.73	.96	3.66	4.81	4.07	3.28	3.26	2.98	1.27	.92	1.62	28.75
Iowa City.....	1.70	1.26	2.31	3.22	4.08	3.73	4.37	2.29	2.72	1.69	1.79	1.78	30.89
Iowa Falls.....	.88	.83	1.23	4.69	3.74	3.69	3.04	2.78	3.03	2.01	1.18	1.24	28.41
Keokuk.....	1.84	1.66	2.21	3.26	3.95	4.48	4.84	2.78	3.66	2.61	2.30	1.84	34.93
Keosauqua.....	1.58	1.18	2.07	4.52	4.59	3.78	3.94	2.40	4.78	1.02	1.27	1.56	32.64
Knoxville.....	.85	.98	1.28	4.75	2.57	3.40	3.76	4.33	3.59	2.10	1.01	1.40	30.05
Larrabee.....	.71	.68	1.55	2.93	3.91	6.19	3.80	3.08	1.97	2.06	.93	1.25	30.26
Logan.....	1.18	1.20	1.68	2.98	4.38	5.58	4.97	3.93	3.06	2.35	1.06	1.32	33.91
Marshalltown.....	.78	.74	1.74	3.93	4.48	3.48	4.60	2.50	2.07	2.84	.89	1.64	29.19
Maxon.....	.63	1.28	1.67	3.50	5.16	3.42	4.20	4.87	2.62	1.55	1.78	1.97	32.65
Maquoketa.....	1.65	1.81	2.35	2.23	4.02	7.37	3.34	2.46	2.54	2.76	1.68	1.93	35.12
McGregor.....	1.38	1.83	1.66	2.47	3.77	4.72	4.88	3.20	3.89	2.38	1.82	1.67	32.07
Mechanicsville.....	1.41	1.13	2.15	3.00	4.30	4.41	3.64	2.08	3.96	1.34	1.63	1.76	30.80
Monticello.....	1.59	1.73	2.39	2.69	3.58	4.46	4.20	3.63	3.76	2.74	2.27	2.26	35.63
Mt. Ayr.....	.82	1.04	2.12	4.09	5.40	4.61	5.06	2.14	2.25	1.80	1.02	1.35	32.50
Mt. Vernon.....	2.24	.86	2.30	3.06	3.74	5.09	3.50	3.47	2.94	2.71	1.59	1.68	31.68
Muscatine.....	1.81	2.04	2.79	3.41	4.38	4.46	3.91	4.38	3.72	3.04	2.30	2.28	26.06

Nashua.....	1.54	2.23	2.76	2.07	4.19	5.35	6.68	3.67	5.81	3.45	2.34	3.94	44.23	11	1878-1888
Newton.....	.81	.98	1.36	3.61	4.55	4.00	3.37	3.50	3.35	2.40	1.84	1.34	31.11	11	1878-1897
Onawa.....	2.32	1.12	1.51	2.79	4.61	5.11	4.23	4.04	2.33	2.11	1.05	1.06	31.28	17	1879-1895
Osage.....	1.40	1.11	1.39	2.89	4.13	4.33	3.45	2.75	3.60	2.40	1.83	1.41	30.24	11	1891-1897
Oakaloosa.....	.90	1.09	2.05	2.25	3.40	4.08	3.73	2.78	2.94	2.21	1.67	1.18	28.23	21	1875-1897
Ovid.....	1.18	1.35	2.10	3.84	3.26	3.51	2.98	3.24	3.60	1.94	1.23	1.70	30.01	5	1893-1897
Panama.....	.36	.55	1.29	4.08	4.09	3.83	4.56	4.13	2.77	2.34	1.08	1.16	30.24	6	1891-1896
Rock Rapids.....	.68	.14	1.74	4.33	2.86	3.74	2.63	1.76	2.30	1.68	.90	.61	23.46	5	1893-1897
Sac City.....	1.15	1.06	.69	3.41	4.16	5.15	3.82	3.28	3.16	2.23	1.17	1.28	30.56	23	1870-1897
Seymour.....	1.45	1.66	1.21	3.95	3.11	4.40	3.46	4.49	4.07	1.61	1.81	1.99	33.21	5	1893-1897
Sibley.....	.95	.33	1.34	3.99	2.95	3.74	3.08	1.82	2.82	2.03	1.12	.81	24.99	5	1893-1897
Smithland.....	.54	.65	.66	2.09	3.50	4.32	2.96	2.77	2.84	1.76	1.71	.63	24.43	9	1879-1897
Storm Lake.....	.81	.68	1.37	2.49	3.47	4.52	3.79	2.66	2.66	1.45	.78	.96	25.66	10	1884-1893
Vinton.....	1.26	.87	1.72	3.22	3.80	3.64	2.81	2.25	2.75	2.31	1.13	1.35	27.11	8	1890-1897
Villisca.....	.62	.64	2.21	4.16	3.74	5.14	5.12	4.91	2.04	1.71	.85	1.00	33.24	5	1893-1897
Washington.....	1.65	.96	2.20	2.70	3.40	3.30	3.76	2.33	2.64	2.39	1.52	1.35	27.22	8	1890-1897
Waterloo.....	1.18	1.11	1.35	2.50	3.55	3.56	4.10	3.60	4.37	2.13	1.40	1.23	30.13	19	1864-1897
Webster City.....	1.11	1.05	1.96	3.81	3.23	3.90	3.88	2.86	1.51	2.10	1.11	1.56	27.48	5	1891-1897
Wesley.....	1.14	1.05	1.41	2.30	3.30	4.74	3.50	2.79	3.52	2.17	1.13	2.16	29.21	12	1879-1890
Winterset.....	.92	.94	1.89	4.69	4.55	5.47	4.96	3.28	3.19	1.75	.83	1.44	33.81	7	1891-1897
Average monthly.....	1.21	1.07	1.81	3.34	4.01	4.44	3.89	3.11	3.08	2.23	1.43	1.50	31.12	..	.....



MEAN TEMPERATURE.

Average monthly and annual mean temperature at various Iowa stations for the period of years named.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Means.	No. years.	Record in-cluded be-tween dates be-low.
Albion.....	11.6	17.3	28.7	45.3	58.4	66.9	70.9	69.0	59.5	49.1	29.7	17.1	42.0	6	1879-1884
Algona.....	16.7	19.0	30.2	48.2	68.3	69.7	73.5	69.0	63.5	48.7	29.5	21.5	45.2	6	1891-1897
Amana.....	14.0	20.7	30.8	48.4	59.5	69.4	73.7	70.2	61.7	48.5	31.9	21.9	45.9	23	1876-1897
Ames.....	15.4	22.4	32.0	48.2	58.9	69.8	75.1	72.0	63.5	50.1	31.5	23.2	46.9	18	1876-1897
Alta.....	14.0	17.9	29.0	47.4	57.6	62.0	72.3	69.9	64.7	49.7	29.0	23.4	45.2	7	1891-1897
Atlantic.....	17.7	24.0	33.0	49.3	58.4	69.7	72.9	70.1	65.8	50.9	33.7	25.9	47.5	7	1891-1897
Audubon.....	17.2	20.4	33.4	50.2	59.8	69.2	73.2	71.6	64.2	49.4	33.2	25.1	47.1	5	1893-1897
Blakeville.....	13.7	23.0	30.0	47.5	55.8	71.2	74.5	71.5	66.3	52.8	34.3	24.5	47.0	4	1890-1893
Belle Plaine.....	17.6	22.6	32.2	49.6	58.3	70.0	78.0	70.0	64.1	49.4	32.4	24.6	47.0	8	1890-1897
Bonaparte.....	20.8	27.0	38.0	52.5	62.5	73.3	76.0	74.3	68.9	54.9	36.3	29.4	51.1	7	1891-1897
Brookside.....	12.7	19.9	29.1	45.1	59.0	68.6	73.4	69.9	61.0	46.6	31.4	17.5	44.5	17	1862-1878
Carroll.....	17.9	20.6	30.6	48.8	58.6	69.9	73.5	70.0	63.8	49.8	31.1	24.2	46.6	8	1890-1897
Cedar Falls.....	15.5	19.2	31.9	49.8	58.8	70.3	73.3	71.5	65.0	50.9	31.1	24.5	43.8	7	1891-1897
Cedar Rapids.....	16.4	21.6	32.4	42.5	59.0	70.5	74.6	71.4	61.8	50.0	34.6	25.1	46.9	16	1882-1897
Centerville.....	21.5	22.7	40.7	54.2	62.2	71.7	76.8	73.6	69.0	52.0	37.0	30.3	51.0	5	1892-1897
Charles City.....	12.5	17.1	29.7	47.1	57.2	68.5	73.7	70.5	63.6	49.4	29.1	21.6	45.0	7	1891-1897
Clarinda.....	20.4	24.2	34.1	52.0	60.6	71.5	75.2	72.9	66.9	53.0	35.8	28.4	49.6	8	1890-1897
Clinton.....	17.7	22.3	35.2	51.3	60.9	71.4	74.0	72.1	65.8	51.4	33.7	27.2	48.5	7	1891-1897
College Springs.....	21.6	26.2	36.8	50.6	60.2	70.3	74.4	73.0	68.4	57.0	37.3	33.8	50.8	7	1891-1897
Corning.....	19.5	21.7	36.2	51.3	60.2	70.0	73.4	71.5	66.3	53.5	35.8	27.0	49.1	6	1892-1897
Oresco.....	9.9	15.7	26.5	44.4	56.4	66.2	70.9	68.6	59.6	46.4	29.4	18.4	42.6	26	1872-1897
Davenport.....	20.7	25.5	34.8	50.1	61.0	70.8	75.1	72.7	64.8	53.4	38.9	27.7	49.4	26	1872-1897
Delaware.....	12.2	17.8	30.2	47.0	57.7	68.4	71.6	68.7	61.7	46.7	29.6	22.3	44.5	7	1891-1897
Decorah.....	11.0	16.8	30.8	50.3	60.0	68.2	70.0	69.6	63.0	49.0	30.4	22.4	45.1	5	1893-1897
Des Moines.....	18.1	23.6	34.6	50.7	60.6	70.2	74.6	72.2	64.6	52.4	36.3	26.4	48.7	20	1878-1897
Dubuque.....	18.3	23.9	32.8	48.9	60.3	69.5	74.4	71.6	63.4	51.1	35.1	25.9	47.8	25	1878-1897
Dysart.....	16.4	22.2	31.5	53.3	63.6	75.2	80.7	77.9	69.9	57.1	37.6	23.9	51.4	10	1879-1896
Elkader.....	12.4	18.9	30.5	40.2	60.6	69.4	73.7	70.1	62.0	48.3	31.3	21.8	45.6	17	1879-1897
Fairfield.....	14.4	22.3	33.0	49.3	59.0	70.0	74.9	70.1	63.8	51.6	35.3	25.2	47.4	12	1879-1897
Fayette.....	15.1	20.0	30.2	47.5	55.8	68.5	71.9	68.6	63.6	48.8	31.1	24.0	45.5	8	1890-1897

Garnavillo.....	9.0	16.3	26.4	43.4	56.8	65.4	69.1	66.6	58.3	46.1	23.9	16.6	41.8	7	1890-1896
Galva.....	13.8	19.4	33.2	49.4	58.4	68.4	74.5	70.0	65.4	49.3	30.4	23.8	46.3	5	1893-1897
Glenwood.....	17.4	23.5	33.0	48.7	59.8	70.4	74.1	71.9	63.1	49.3	33.8	25.0	47.4	28	1897-1897
Grand Meadow.....	13.7	19.5	30.5	117.6	57.4	66.7	70.1	67.9	62.9	48.6	30.6	23.4	44.9	7	1891-1897
Greenfield.....	19.3	22.6	34.7	51.0	59.4	70.4	74.0	71.9	66.0	53.1	33.9	26.3	48.5	7	1891-1897
Grinnell.....	17.6	23.1	32.4	51.0	59.4	73.0	72.7	70.0	63.0	47.1	34.7	25.6	47.5	8	1890-1897
Grundy Center.....	13.7	19.8	31.5	49.0	58.1	69.6	72.0	69.6	63.9	50.1	30.6	24.0	46.0	7	1891-1897
Guttenburg.....	14.0	20.0	28.7	44.5	57.8	66.7	70.6	67.9	60.5	47.1	31.9	19.3	44.0	23	1894-1895
Hampton.....	13.1	17.8	28.2	46.8	56.8	67.8	71.5	68.5	62.2	48.4	29.6	21.8	44.4	8	1890-1897
Hopeville.....	19.7	23.4	34.6	52.0	60.0	70.0	73.3	71.9	67.1	53.6	34.0	26.7	49.9	7	1891-1897
Independence.....	14.7	20.3	30.2	47.2	59.4	61.9	71.1	68.0	59.9	47.1	33.0	21.2	44.8	36	1861-1897
Indianola.....	19.3	24.8	36.2	52.5	60.5	70.6	74.2	72.6	66.8	54.3	35.8	26.6	49.5	6	1892-1897
Iowa City.....	20.5	24.9	34.5	51.1	59.4	71.1	73.7	70.5	65.0	52.0	36.0	27.8	43.9	8	1890-1897
Iowa Falls.....	12.2	17.2	30.8	47.2	54.0	68.4	72.4	68.8	62.4	48.4	29.8	22.2	44.9	5	1893-1897
Keokuk.....	23.3	28.5	37.5	51.4	62.7	72.3	76.9	74.4	66.6	54.7	38.8	29.9	51.4	27	1871-1897
Keosauqua.....	21.5	26.3	38.7	53.0	62.0	73.2	76.5	74.0	68.0	55.2	37.3	27.6	51.1	6	1892-1897
Knoxville.....	23.8	24.2	36.2	53.7	63.0	71.8	75.6	72.8	67.0	52.2	36.0	26.4	50.1	5	1893-1897
Larrabee.....	15.9	20.3	30.1	48.7	57.9	69.6	72.6	70.1	64.7	49.9	30.0	23.6	46.1	7	1891-1897
Logan.....	19.9	23.9	33.6	52.4	60.1	71.5	74.9	72.0	66.5	52.9	34.9	25.3	48.2	33	1890-1897
Marshalltown.....	16.3	21.2	30.7	49.3	58.3	69.0	72.2	70.3	64.5	51.2	33.6	23.6	46.7	6	1891-1897
Maxon.....	17.0	23.2	35.4	52.4	62.0	72.7	75.8	73.5	66.7	51.6	33.8	26.4	49.8	6	1891-1897
Maquoketa.....	17.0	25.6	35.1	48.3	61.0	71.4	76.3	71.9	64.8	53.3	36.0	26.1	48.9	5	1881-1897
Mechanicsville.....	15.2	20.2	34.8	49.2	59.0	69.6	73.0	71.2	62.6	49.4	32.2	25.2	46.6	5	1892-1896
Monticello.....	15.2	21.4	31.8	48.3	59.2	68.7	72.9	70.0	61.6	48.5	33.2	22.2	46.1	44	1854-1897
Mt. Ayr.....	21.0	26.3	35.5	52.8	62.2	70.6	75.4	72.6	63.4	53.8	35.5	26.6	50.1	5	1892-1897
Mt. Vernon.....	13.4	20.7	35.7	52.1	61.0	72.2	75.6	72.3	65.4	51.0	34.3	25.7	43.7	7	1890-1897
Nashua.....	15.4	26.0	41.8	54.9	64.7	64.7	70.6	66.3	57.1	48.2	30.6	18.1	41.8	9	1879-1887
Newton.....	15.6	21.5	33.9	48.5	60.5	70.3	74.9	71.6	62.3	50.4	32.8	22.2	47.0	11	1878-1897
Osage.....	11.4	17.0	26.5	45.0	55.9	66.2	69.7	66.1	59.2	43.6	26.4	20.2	42.3	7	1891-1897
Oakaloosa.....	17.1	22.2	33.9	50.3	59.9	69.8	74.8	71.0	64.3	50.7	35.8	26.6	48.0	15	1883-1897
Ovid.....	22.0	24.5	37.0	53.5	61.6	71.2	75.6	73.6	68.0	53.4	36.8	27.4	50.3	5	1896-1897
Panama.....	18.5	21.2	33.0	50.7	59.2	69.3	72.3	71.0	65.0	49.5	31.8	26.2	47.2	6	1891-1896
Rock Rapids.....	13.0	17.0	28.8	49.2	57.6	68.4	73.4	69.8	63.0	48.4	28.0	21.0	44.8	5	1893-1897
Sac City.....	13.3	19.6	31.0	48.8	59.0	71.8	76.4	72.5	64.0	51.5	33.3	23.6	47.2	19	1870-1897
Seymour.....	23.2	26.5	38.8	53.4	61.8	71.8	76.6	74.0	68.2	54.2	36.8	31.0	51.3	5	1893-1897
Sibley.....	8.5	17.2	29.8	49.0	58.2	67.2	70.4	67.5	62.0	49.0	27.3	20.0	44.0	5	1893-1897
Smithland.....	14.4	17.0	28.5	44.5	63.1	67.9	70.7	70.9	56.8	49.5	26.9	16.4	43.9	4	1879-1882
Vinton.....	16.5	21.8	31.8	49.1	58.6	69.8	73.1	69.4	63.0	50.0	32.9	25.2	46.8	8	1890-1897
Villisca.....	19.8	24.0	35.8	52.8	61.8	70.8	74.2	70.2	65.2	51.2	35.0	30.4	48.4	5	1893-1897

MEAN TEMPERATURE—CONTINUED.

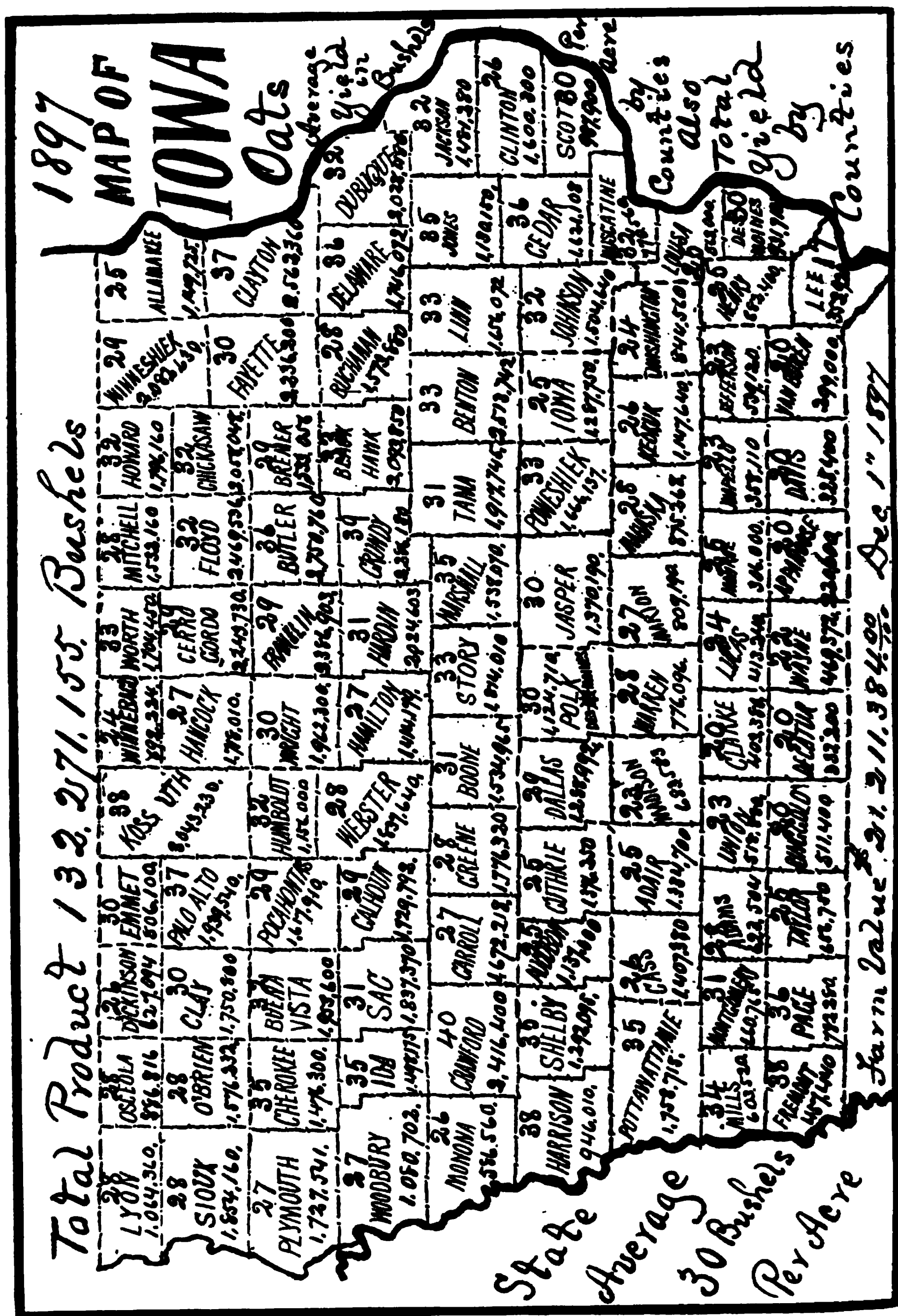
STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.	No. years.	Record in-cluded be-tween dates be-low.
Washington.....	21.1	25.5	34.9	52.9	61.2	73.6	76.5	73.1	67.0	52.9	35.9	27.4	50.2	8	1890-1897
Waterloo.....	16.5	21.9	32.6	50.5	63.8	72.9	78.0	74.6	66.1	52.4	36.9	23.7	49.2	19	1963-1897
Webster City.....	15.2	18.8	30.4	46.4	56.8	69.4	73.8	70.8	65.4	50.8	31.0	22.2	45.9	5	1891-1897
Wesley.....	15.1	22.2	34.4	54.7	60.3	74.7	77.6	75.7	66.4	54.2	35.8	22.8	49.5	13	1879-1891
Winterset.....	19.0	23.3	33.7	51.6	60.4	70.3	73.6	71.3	66.0	53.0	33.5	26.3	48.4	7	1891-1897
Means .....	17.8	21.5	32.8	49.5	57.4	70.0	73.7	71.0	64.5	50.7	33.0	23.7	47.0	.....	.....

NOTE: The following maps were engraved for the annual report of the Agricultural Society, and are inserted in this volume by courtesy of Secretary Fowler.



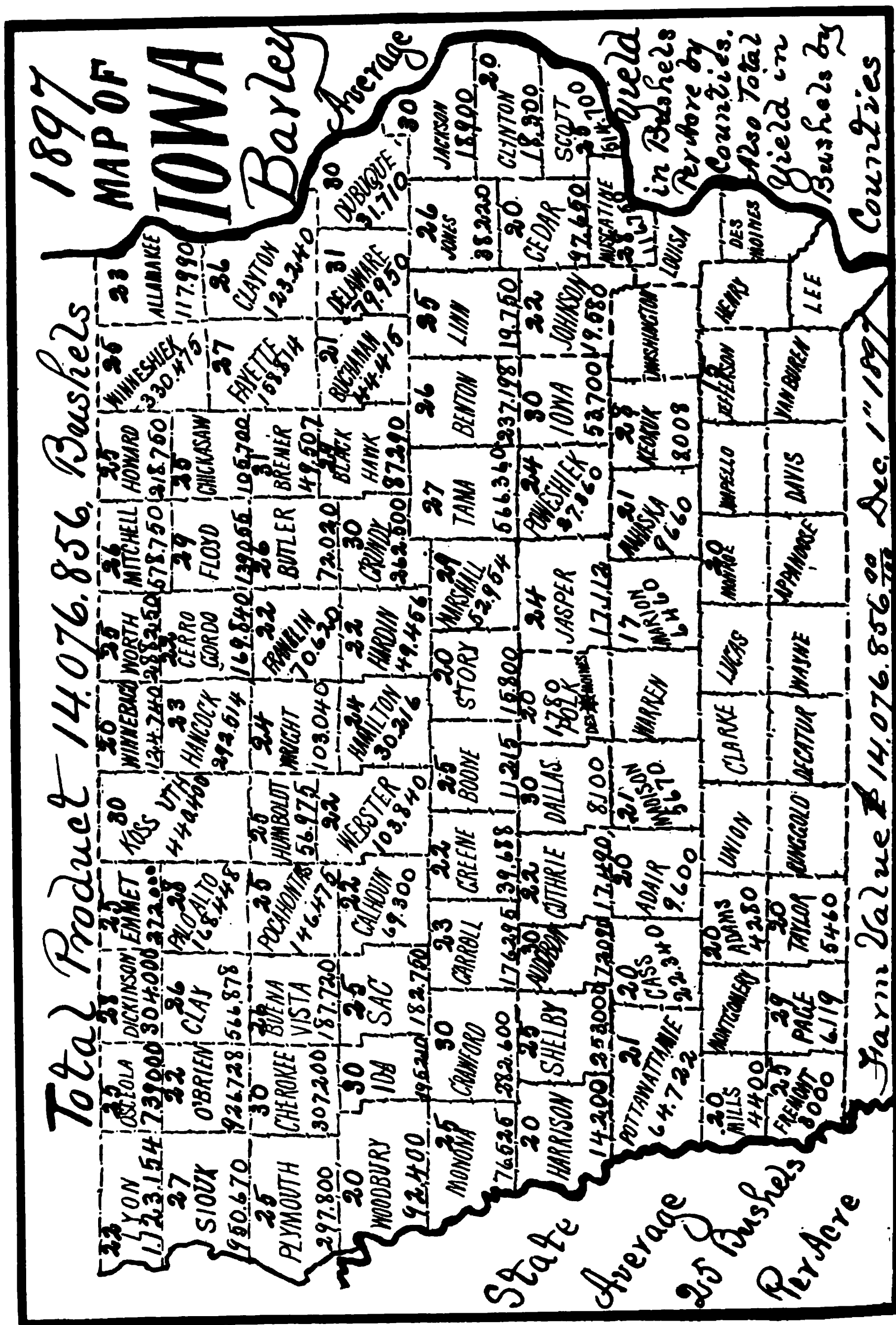




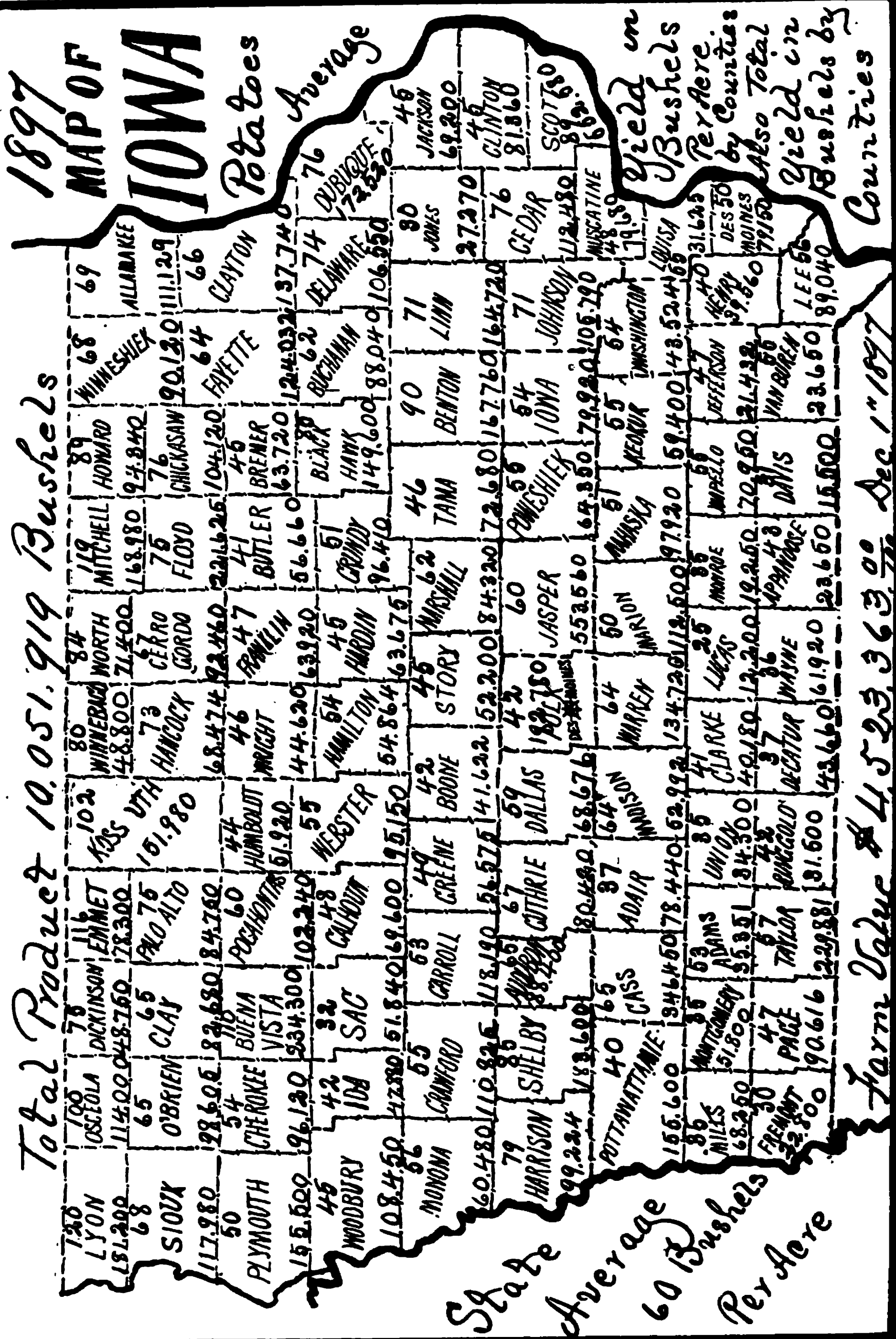




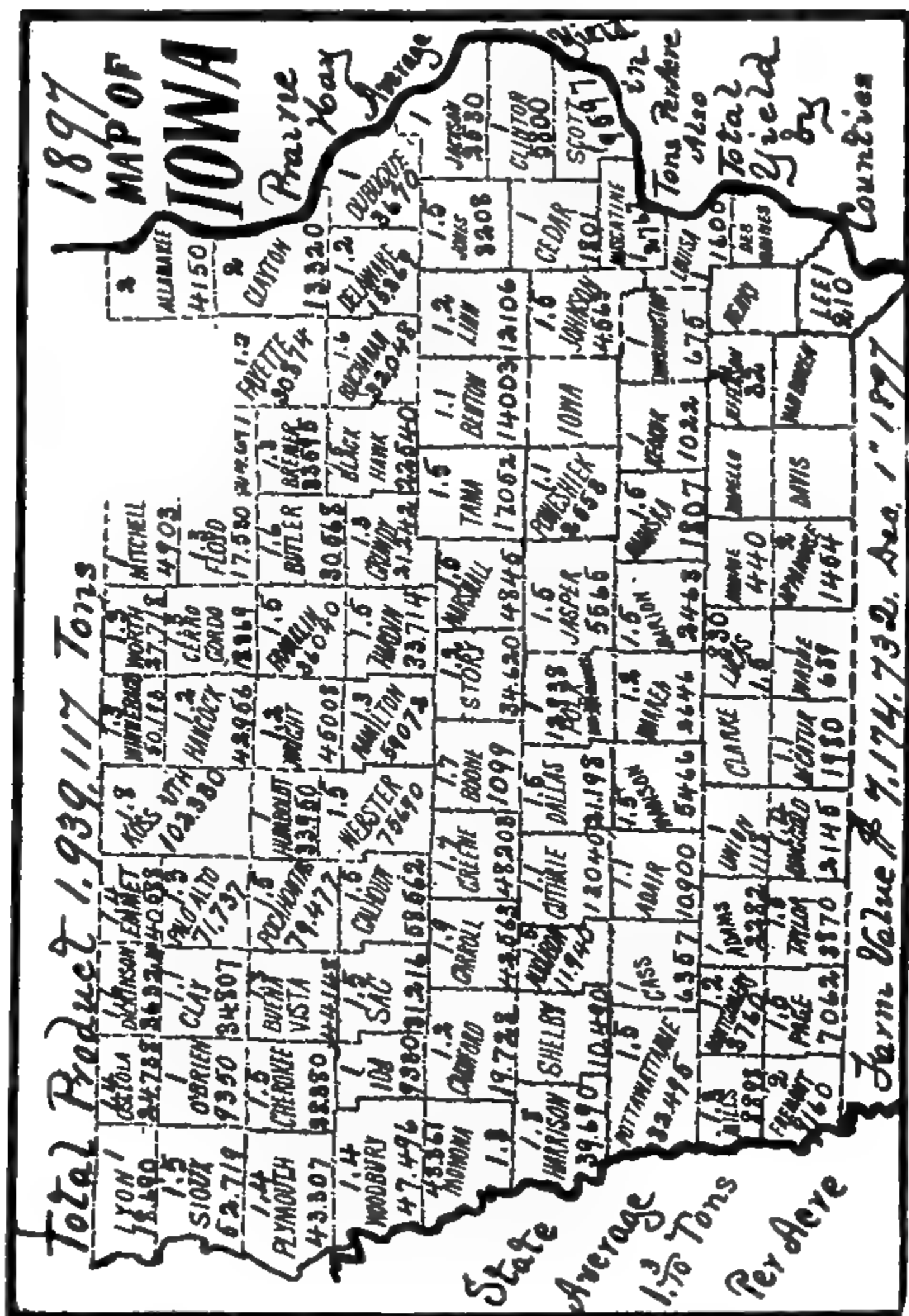




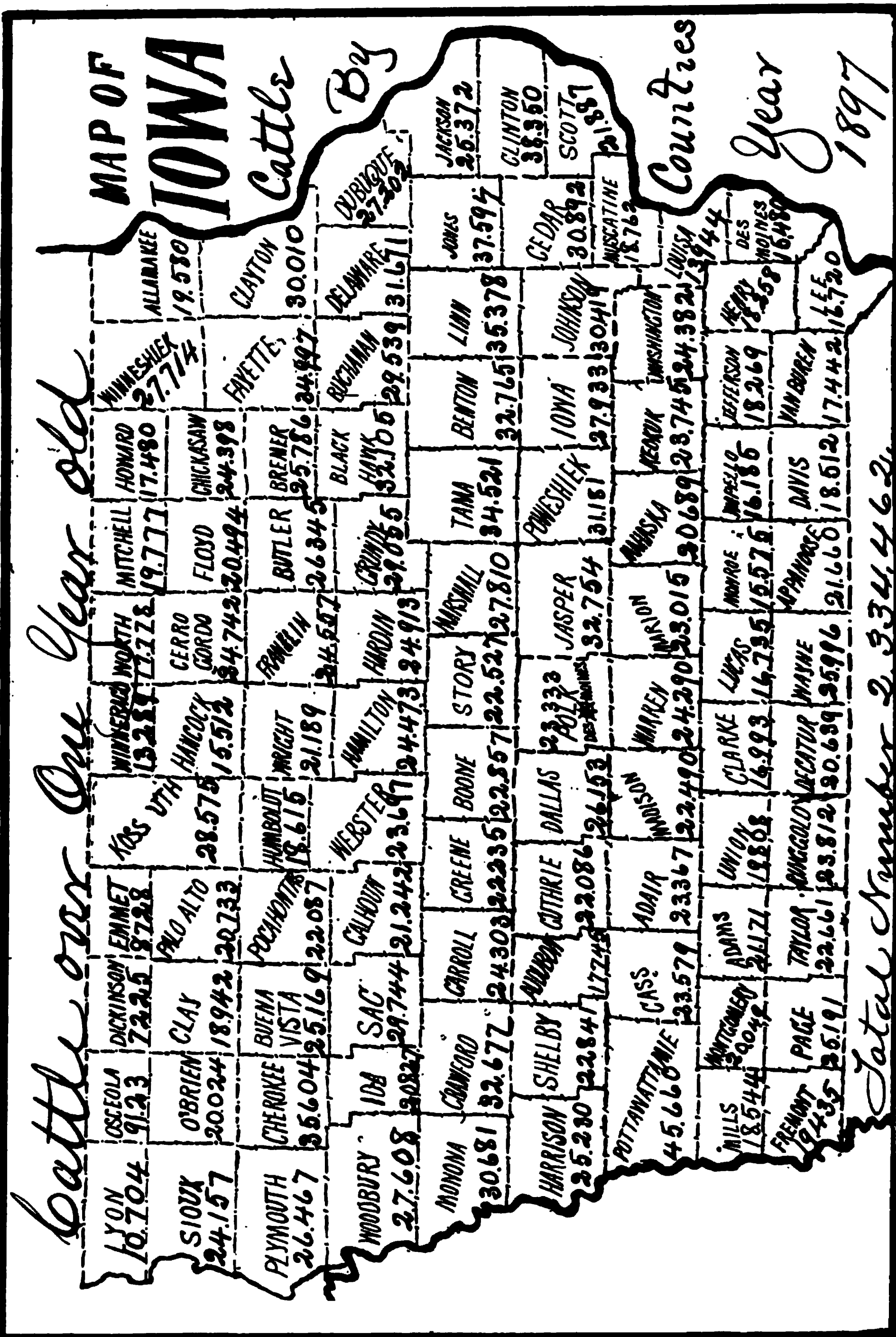










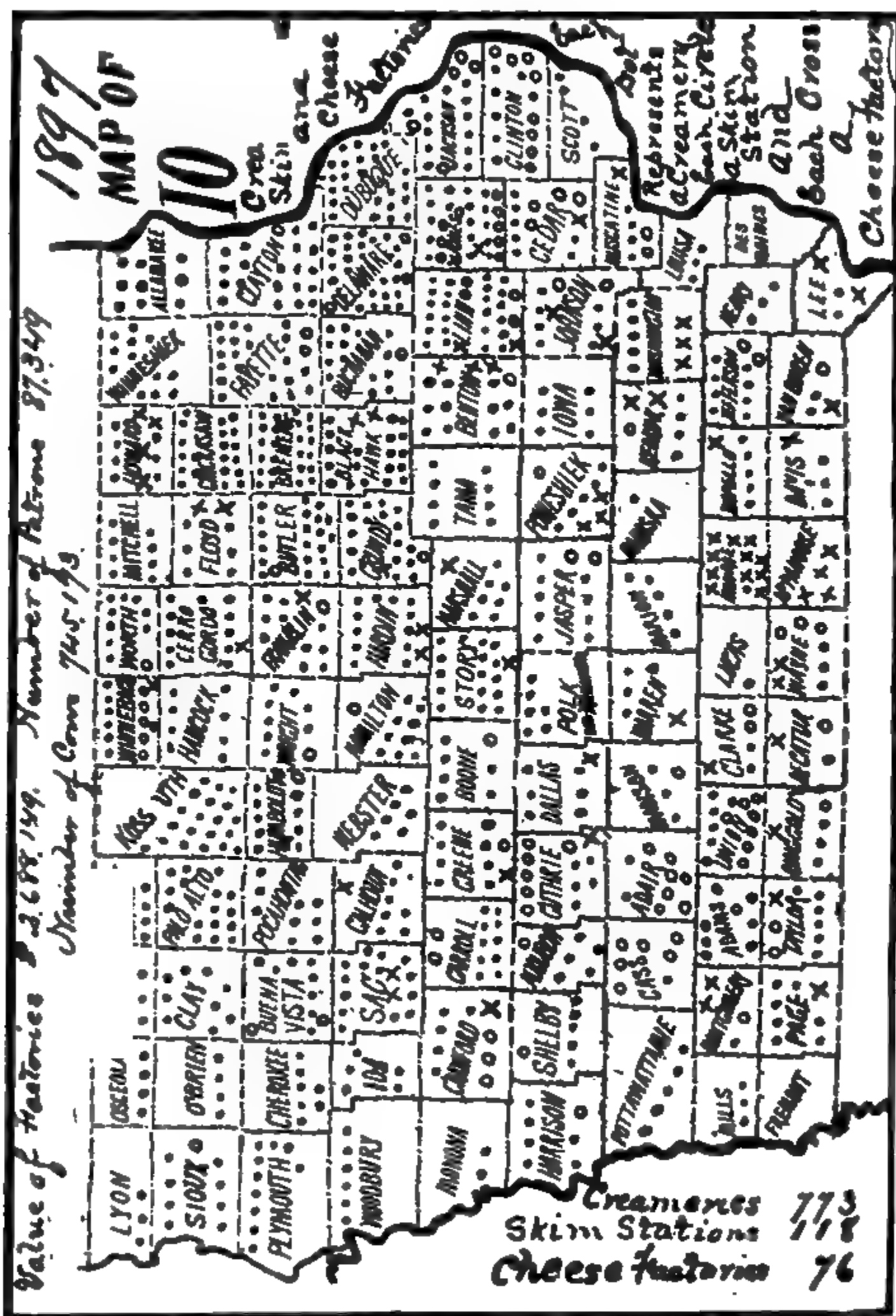


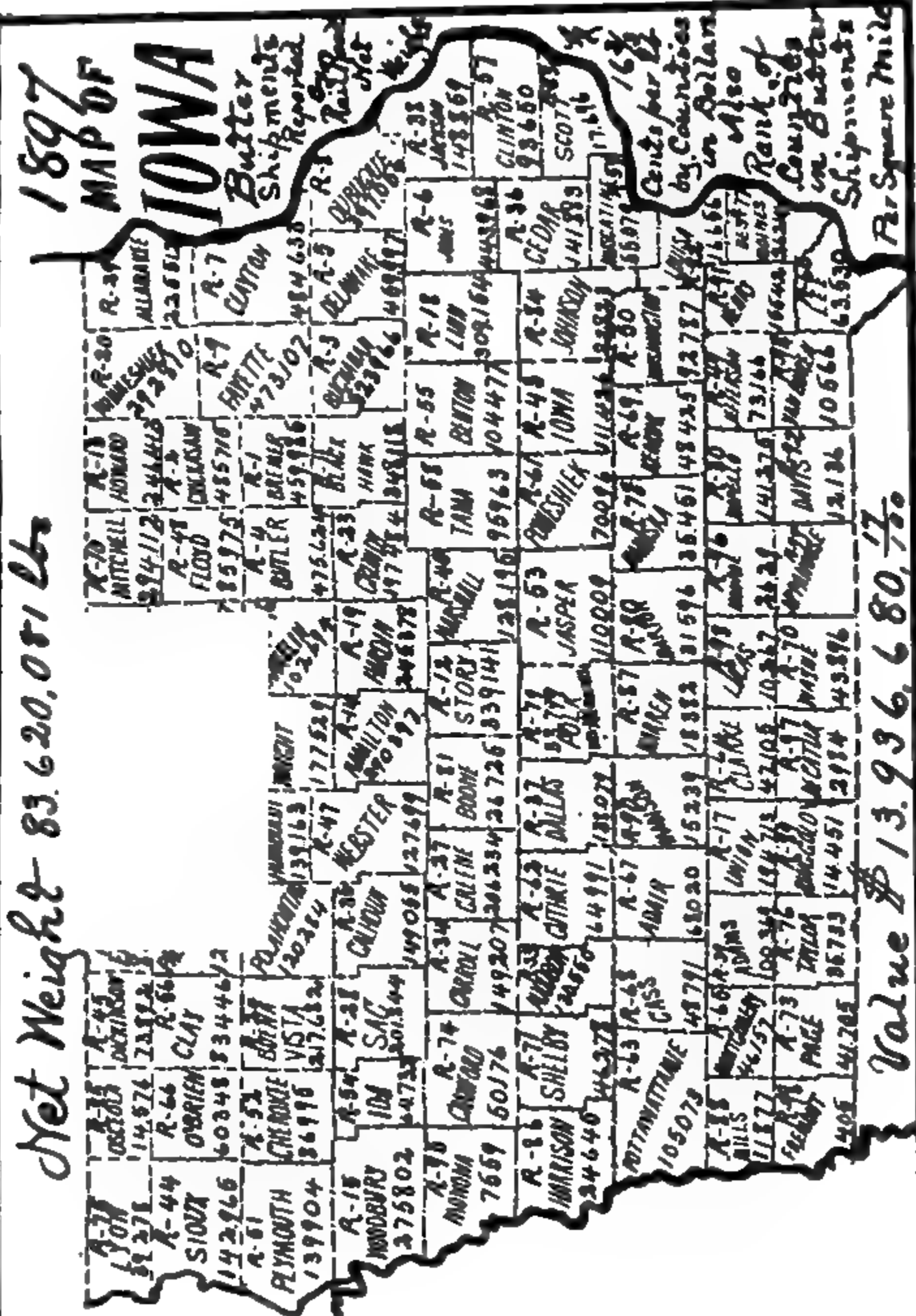












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UNITED STATES  
DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU.

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ANNUAL REPORT

OF THE

# Iowa Weather and Crop Service

IN CO-OPERATION WITH THE  
UNITED STATES WEATHER BUREAU,  
FOR THE YEAR 1898.

---

JOHN R. SAGE,  
*Director.*

GEO. M. CHAPPEL, M. D.,  
*Local Forecast Official U. S. Weather Bureau,  
Assistant Director*

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PRINTED BY ORDER OF THE GENERAL ASSEMBLY.

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DES MOINES:  
F. R. CONAWAY, STATE PRINTER,  
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STATE OF IOWA,  
OFFICE OF THE WEATHER AND CROP SERVICE, }  
DES MOINES, February 1, 1899.

*To His Excellency, Leslie M. Shaw, Governor of Iowa:*

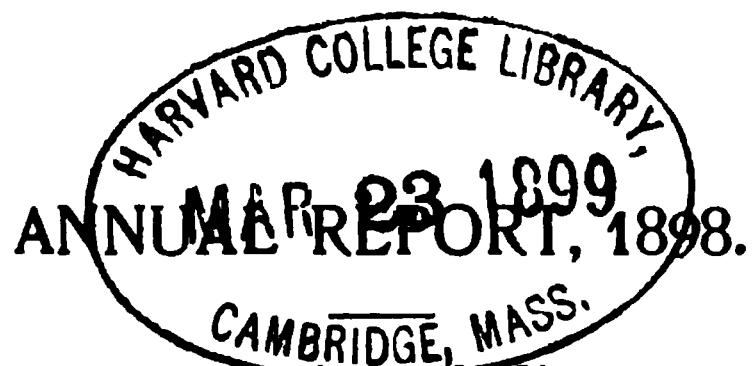
SIR—In accordance with the requirements of the law, we have the honor to submit herewith the ninth annual report of the Iowa Weather and Crop Service for the year 1898.

We are, sir, very respectfully your obedient servants,

JOHN R. SAGE,  
*Director.*

GEO. M. CHAPPEL, M. D.,  
*Local Forecast Official U. S. Weather Bureau,*  
*Assistant Director.*





## ANNUAL REPORT, 1898.

This report is a compilation of climate and crop data collected in accordance with the provisions of the law of the state, in coöperation with the Weather Bureau of the U. S. Department of Agriculture. The salient features of the climate, and the important statistics relating to the products of the soil during the year 1898, are herein presented in convenient form for reference and comparison in future years. There is an increasing public demand, both at home and abroad, for reliable statistical information in regard to the general climatic conditions and the products of the soil of this foremost agricultural state. The value of systematic and continuous records of atmospheric changes cannot be overestimated. They are of special interest to students of science, and of practical value to all classes of business men. And the statistics of farm products are highly valued and carefully studied by men engaged in commercial lines, transportation, and farming.

The U. S. Weather Bureau maintains five fully equipped meteorological stations within the territorial limits of this state; viz: at Des Moines, Davenport, Dubuque, Keokuk, and Sioux City. The records of the station at Omaha, Neb., are included in the meteorological records of this service. In addition to these regular stations the work of meteorological observation is now being carried on at 138 local stations, by competent voluntary observers, equipped with standard instruments for making records of daily temperature and precipitation. These public-spirited and faithful observers perform the exacting task of making systematic and continuous daily records of weather conditions without expense to the state, except the moderate amount required for the purchase of the necessary instruments. The results of the work for the year at all these weather bureau and other stations are presented in condensed form in the summaries and tables included in this report. There has been a net increase of nine stations since the close of the year 1897.

As an auxiliary to this able and efficient corps of meteorological observers, this service includes over 800 crop reporters, who report weekly or monthly the condition of the principal crops as affected by prevalent weather conditions during the crop-growing season. By this coöperation of the government



and the state, assisted by intelligent and public-spirited citizens, the most valuable results are secured at a minimum of cost for the service. These three contributing factors—the government, the State Weather and Crop Service, and the corps of generous citizens who report weather and crop conditions in their respective localities—are all essential to the production of the high measure of utility that has been attained.

The various publications of this service have been widely distributed, and there is a constantly increasing demand for the Monthly Review and weekly climate and crop bulletins issued from this office. The issues of the Review amounted to something over 2,500 copies per month, or an aggregate of over 30,000 copies during the year. The Bulletins issued during the crop season—April 1st to October 1st—amounted to about 38,000 copies. The summaries of the Bulletins were also distributed to the press of the state and by that means valuable information in relation to the growing crops was widely disseminated. Requests have been received from public libraries in various parts of the United States for full sets of the annual reports of this service, and it is a matter of regret that the issues for the years 1890 and 1894 are exhausted. It has also been found impossible to supply complete sets of the Monthly Review for all the years since the establishment of this service. During the past year the gratifying fact has been noted that teachers of science in the high schools and colleges are becoming much interested in the study of climatic data, as indicated by requests received from this class for copies of monthly and annual reports. The time is evidently near at hand when there will be a demand for text-books of meteorology to be used in the public schools.

At the close of the year daily weather forecasts were received by telegraph at 120 stations, and from these stations and the central office they were distributed by mail to 1,122 postoffices, arriving in due time to be serviceable to the general public. At the telegraph stations signal flags are displayed, and by these various means the forecasts are seen by a very large percentage of the people of this state. The time is not distant when most of the farms and country neighborhoods will be connected by telephone with the towns and postoffices, and the weather reports will be received daily by all farmers who desire to receive the benefits of the service.

## METEOROLOGICAL STATIONS AND OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Adair.....	F. L. Morrison.	LeClaire .....	River Observer.
Afton.....	Hon. N. W. Rowell.	Lansing .....	G. H. Markley.
Albia.....	B. Moore.	Larchwood.....	K. F. Walker.
Algona .....	O. D. Pettibone.	Larrabee.....	H.
Alta.....	D. E. Hadden.	Lenox.....	J.
Alta (near).....	W. J. Minard.	Le Mars.....	D.
Amana.....	O. ....	Linn Grove .....	R.
Ames.....	E.	Logan.....	M.
Ames (6 miles s.e.)	L.	Malvern.....	R.
Atlantic .....	J.	Maquoketa.....	D.
Andubon.....	P.	Mason City.....	B.
Bedford.....	P. .... rison.	Marshalltown .....	O.
Belknap.....	A.	Millman .....	W.
Belle Plaine .....	S.	Monticello.....	C.
Bonaparte.....	H.	Moore.....	P.
Britt.....	G.	Mount Vernon.....	P.
Burlington.....	P.	Mt. Ayr.....	A.
Carroll.....	Wm. E. Minn.	Mt. Pleasant.....	D.
Cedar Falls.....	Prof. A. O. Page.	Neola.....	J.
Cedar Rapids.....	Electric Lt. & Power Co.	New Hampton.....	R.
Centerville*.....	J. W. Tanner.	Newton.....	A.
Chariton.....	Hon. S. H. Mallory.	Northwood.....	A.
Charles City.....	Chas. O. Schmidt.	Odebolt.....	E.
Cherokee.....	Hon. L. W. Beal.	Ogden.....	E.
Clarinda.....	A. S. Van Sandt.	Olin.....	H.
Clear Lake.....	A. S. Hawley.	Omaha, Neb.....	H.
Clinton.....	Luke Roberts.	Osceola.....	A.
College Springs..	A. M. Finley.	Ovid.....	H.
Corning.....	John W. Sixby.	Osage.....	G.
Council Bluffs..	J. B. Eichel.	Oskaloosa.....	J.
Oresco.....	Gregory Marshall.	Ottumwa.....	D.
Davenport.....	†J. M. Sherrier.	Parnell.....	H.
Delaware.....	Wm. Ball.	Pella.....	T.
Decorah.....	F. H. Baker.	Pioneer.....	A.
Denison.....	James H. Holmes.	Plover.....	J. S. Smith.
Des Moines.....	†Geo. M. Chappel, M. D.	Portsmouth.....	J. W. Dahlheimer.
Dows.....	R. E. Fuller.	Pringhar.....	P. E. Bailey.
Dubuque.....	†E. H. Bowie.	Red Oak.....	William Boll.
Eagle Grove.....	Smallpage Bros.	Reinbeck.....	Dr. L. B. Hathaway.
Eldon.....	T. Madden.	Ridgeway.....	Arthur Betts.
Eldora.....	Prof. O. F. Woodward.	Rock Rapids.....	W. C. Wyckoff.
Elkader.....	Chas. Reinecke.	Stockwell City .....	O. M. Randall.
Estherville.....	M. L. Archer.	Ruthven.....	H. Cook.
Fairfield.....	Charles J. Fulton.	Sac City.....	Dr. C. Brown.
Fayette.....	B. Z. Latimer.	Sibley.....	H. G. Doolittle.
Ft. Madison.....	Miss L. A. McCreedy..	Sidney.....	G. V. Swearingen.
Fonda.....	Chas. F. Linnan.	Sigourney.....	Mrs. E. F. Ashbaugh.
Forest City.....	J. A. Peters.	Sioux City.....	†U. G. Pursell.
Fredericksburg..	J. D. Herrick.	Spencer.....	S. Gillespie.
Galva.....	J. M. Crowley.	Spirit Lake.....	W. O. Drummond.
Garden Grove.....	J. R. White.	Storm Lake.....	Prof. M. L. Fuller.
Gladbrook.....	Geo. F. Parker.	Stuart.....	H. W. Boatright.
Glenwood.....	J. P. Jackson.	St. Charles.....	B. D. Minard.
Grand Meadow ..	F. L. Williams.	Tara.....	W. E. Humphrey.
Greene.....	J. L. Cole.	Thurman.....	O. B. Paul.
Greenfield.....	J. G. Oliver.	Toledo.....	Chas. Mason.
Grinnell.....	Prof. N. J. Buck.	Vinton.....	T. F. McQuinn.
Grundy Center..	Geo. F. Ellis.	Villisca.....	O. E. Matteson.
Guthrie Center..	Oscar Klingman.	Wapello.....	Geo. W. Schofield.
Hampton.....	E. O. Grenelle.	Washington.....	Wm. A. Cook.
Hedrick.....	J. T. Brooks.	Washta.....	H. L. Felter.
Hawkeye.....	Beatrice Kirkendall.	Waterloo.....	M. L. Newton.
Hopeville.....	M. T. Ashley.	Waverly.....	H. S. Hoover.
Huxford.....	H. S. Wells.	Waukeo.....	N. C. Wragg.
Independence....	E. F. Wulke.	Webster City.....	Louis Frank.
Indianola.....	Prof. J. L. Tilton.	What Cheer.....	Hon. J. O. Beem.
Iowa City.....	Prof. A. A. Veblen.	William.....	Dr. Frank P. Butler.
Iowa Falls.....	J. B. Parmelee.	Wilton Junction..	J. M. Rider.
Keokuk.....	†Fred Z. Gosewisch.	Winterset.....	W. W. McKnight.
Kearsauqua.....	Prof. J. H. Landes.	West Bend.....	Phil. Dorweiler.
Knoxville.....	Osney and Beaver.	West Union.....	J. M. Lisher.
Lamoni.....	T. J. Fitzpatrick.	West Branch.....	A. A. Madson.

\*Walsh P. O. †U. S. Weather Bureau. ‡Postville P. O. §Mt. Vernon P. O. ¶Des Moines P. O.

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### METEOROLOGICAL SUMMARY FOR 1898.

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The general climatic conditions for the state were about normal. The mean pressure of the atmosphere, as shown by barometric records, was 30.03 inches. The highest barometer reading was 31.07 inches, at Clarinda, on December 9th; lowest, 29.30 inches, at Davenport and Dubuque, on November 21st. The range for the state was 1.77 inches.

The mean temperature of the state for the year, as deduced from the complete records of ninety-one stations, was 47.6°, which is practically normal. Dividing the state into sections, or belts, three counties wide, on lines east and west, the averages are as follows: Northern section, 45.7°; central section, 47.6°; southern section, 49.7°. The highest temperature recorded was 103°, at Council Bluffs and Clarinda, on August 20th; lowest, 25° below zero, at Estherville, Mason City and Ruthven, on December 25th. The range of temperature was 128°.

The average precipitation (rain and melted snow) for the state was 31.69 inches, as shown by the complete records of ninety-one stations. By sections, the average was as follows: Northern section, 27.72 inches; central section, 31.04 inches; southern section, 36.34 inches. Included in these figures the northern section had 31.6 inches of snowfall; central section, 44 inches; southern section, 40.3 inches; the average snowfall for the state being 38.6 inches.

Among the high measurements of precipitation for the year are the following: Bonaparte, 55.47 inches; Keokuk, 52.48 inches; Moor, 48.93 inches; Ovid, 46.43 inches; Clinton, 46.15 inches; Thurman, 44.11 inches; Sidney,

43.42 inches; Belle Plaine, 42.25 inches. Larchwood reported the lowest amount, 19.51 inches. Estherville received only 20.89 inches.

The greatest amount of rainfall in twenty-four hours was 9.70 inches, on July 6th and 7th.

The prevailing wind direction was northwest; highest velocity registered, sixty-six miles per hour, at Sioux City, on June 24th. There were 160 clear days, 105 partly cloudy and 100 cloudy days during the year.

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## MONTHLY METEOROLOGICAL SUMMARIES.

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### JANUARY.

The mean barometric pressure for January was 30.09 inches; the highest pressure observed was 30.70 inches, at Sioux City and Clarinda, on the 1st; lowest, 29.34 inches, at Keokuk, on the 25th; range, 1.36 inches.

The month was warmer than usual, the mean temperature for the state, as shown by records of 106 stations, being 23.4°. The lowest temperature recorded was 11° below zero, at Cedar Rapids, on the 27th.

The average precipitation for the state was 1.60 inches, which is nearly the normal amount for January. It was an unusually mild January for this latitude, with less than the average number of severe storms.

### OBSERVERS' NOTES.

*Clinton*—DR. LUKE ROBERTS. The meteorological conditions of January, 1898, were markedly different from its last nineteen predecessors. In temperature it was 3.8° above a normal mean. My maximum and minimum temperatures only go back seventeen years, and during that time the minimum temperature for January was below zero from 9° to 36° except in 1891, when it was zero, and in 1898, when it was 1° above. The normal minimum is 24.6° below zero, which makes the minimum for 1898, 24.6° above normal. The maximum temperature was 56°, or 3° below normal. The warmest day was the 11th, with a mean temperature of 36.7°. The coldest day was the 31st—mean temperature 10°. The normal temperature for the warmest and coldest January days, is 37.8° for the former, and 4.4° below zero for the latter. The coldest January day for the last twenty years was the 5th, in 1884, the mean temperature being 30.5° below zero. The warmest day for the same time was the 1st, 1897, the mean being 54°; 21 inches of snow fell during the month. Total precipitation, rain and snow, netted 3.60 inches. This was in excess of January means by 1.6 inches. There were six stormy days, being two less than normal. The movement of the wind was decidedly sluggish, except on two days, the average for the month being only four miles per day. The total movement being only 2,960 miles, while a January normal is 5,070 miles.

*Belknap*—A. W. RANKIN. January, 1898, goes out with fully two feet of snow on the level and five to seven feet in places. Very near all of the precipitation of January (five inches) lies on the surface in the shape of snow and ice.

*Bonaparte*—HON. B. R. VALE. A pleasant month for feeding and for work. Fully eighteen inches of snow in sight at close. Only two notable storms, viz., 22d and 25th.

*Forest City*—J. A. PETERS. Only three days of zero weather. Good sleighing all the month.

*Grand Meadow*—F. L. WILLIAMS. The month was unusually pleasant; only once did the mercury reach zero; neither was it warm enough to have any mud. Fine sleighing all of the time and no drifts.

*Lamoni*—T. J. FITZPATRICK. Thunder and lightning on the 11th was rather pronounced and remarkable for the season. A heavy snowstorm raged all day the 25th. Trains blockaded until the next day. The worst storm in many years.

*Larrabee*—H. B. STREVER. Such a January has been seldom seen; so mild and free from storms and wind; so enjoyable throughout.

*Logan*—MRS. M. B. STERN. We have had no bad storms, but considerable cloudy weather. Very little wind. Altogether a rather mild winter.

*Ovid*—H. C. MILLER. A remarkable warm month. Thawed twenty-three days of the thirty-one. No frost in the ground except in the bare spots.

*Sidney*—G. V. SWEARINGEN. On the 22d a high wind came with the snow, which fell to the depth of 5.2 inches. Sledding has been from good to fair since December 4, 1897.

#### FEBRUARY.

The mean pressure for the month was 30.13 inches. At Clarinda on the 2d the highest reading was recorded, 30.86 inches; lowest, 29.58, at Clarinda, on the 16th; range for the state, 1.28 inches.

The month was warmer and drier than usual. The monthly mean temperature, as shown by reports from 104 stations, was 24° 2', which is slightly above the normal. Keosauqua reported the highest temperature, 62°, on the 8th. The lowest temperature reported was 18° below, on the 1st, at Iowa Falls.

The average precipitation for the state, according to reports from 106 stations, was 1.20 inches, a little below the normal for February. Cedar Rapids reported the greatest amount, 3.65 inches; and the least amount was .1 of an inch at Denison. There were no severe storms of wide extent; number of clear days, 10; cloudy, 9; partly cloudy, 9.

#### OBSERVERS' NOTES.

*Bonaparte*—HON. B. R. VALE. A very even-toned month. Fair roads; kind on stock; good for feeding, and all in all, a very profitable month.

*Clarinda*—H. S. VAN SANDT. High wind and fine snow night of 1st and 2d (40 miles); a genuine blizzard. Much damage to trees from heavy sleet of 9th and 10th. Telegraph and telephone lines and poles broken, and service badly demoralized.

*Cresco*—GREGORY MARSHALL. February 2d, blizzard from northwest early A. M.; snow of last month all drifted into heaps; travel impeded.

*Dows*—R. E. FULLER. February 20th, snow drifted all day; the air was thick with it to a height of 30 feet.

*Fayette*—R. Z. LATIMER. High wind on the 1st and 2d, also on the evening of the 5th. The worst storm of the month was on the 18th, 19th and 20th. Trains were delayed several hours.

*Forest City*—J. A. PETERS. Robins were singing on the 8th, and again on the 27th.

*Grand Meadow*—F. L. WILLIAMS. Except for the first three days the month was warm. Sleighing good most of the time. Snow drifted very little.

*Greenfield*—J. G. CULVER. Night of 9th-10th one of the heaviest sleet storms for many years. Sleet one inch thick by many measurements. Fruit and shade trees badly broken. Telephone, telegraph and electric light wires down. This will probably be known as the "great sleet." First visit of the robins 26th.

*Humboldt*—HENRY S. WELLS. There has been good sleighing all the month. The winter has been uniform. Stock has done well.

*Lamoni*—T. J. FITZPATRICK. During the night of the 1st and all day of the 2d, a stiff northwest wind prevailed, causing heavy drifts of snow, which blockaded the trains for hours. Thunder and lightning, unusual for the time of year, occurred on the 9th.

#### MARCH.

The mean pressure of the atmosphere was 30.08 inches; the highest observed being 30.58 inches; lowest, 29.43.

The month was warmer than usual, the mean temperature for the state, as deduced from 107 station records, being 37.5°. Fort Madison reported the highest mean, 44.6°, and Osage the lowest, 32.4°. The maximum temperature registered was 72°, at College Springs, on the 26th, and the minimum was 2°, at Eldora, Neola and Rock Rapids, on the 1st, 22d and 23d. There was an average monthly range of 54°.

The average precipitation was 1.94 inches, which is slightly above the March average for the state. The eastern counties received much the heavier rainfall. Fort Madison reported 6.21 inches, and Marshalltown only .33 of an inch. The highest wind velocity was sixty miles an hour, at Sioux City, on the 14th. There were 12 clear days, 9 partly cloudy and 10 cloudy.

#### OBSERVERS' NOTES.

*Amana*—C. SCHADT. The snow which commenced to fall in the beginning of December, before the ground was frozen to any considerable depth, afforded ample protection to fall wheat, rye and other plants and shrubs during the whole winter. At the close of February and beginning of March it melted away without causing much flow of water and percolated, apparently, nearly all into the ground, which was a great boon to farming. March was unusually mild and warm, so that sowing and planting (onions) began early. Toward the close of the month, however, cold weather set in and caused some damage, the extent of which cannot be estimated.

*Bonaparte*—HON. B. R. VALE. The 10th and 27th, inclusive, gave 5.08 inches rain—an unprecedented rainfall for March. Mercury dropped to 17° on the 23d, and to 22° on the 28th and 29th. No farm or field work done yet.

*Clinton*—DR. LUKE ROBERTS. March, 1898, took a departure from normal on all points. Its maximum temperature, minimum temperature, mean temperature of the warmest day, mean temperature of the coldest day were each above the normal. The rainfall, range of temperature, number of storm days, number of cloudy, number of clear days and the per cent of cloudiness were each in excess of normal. The movement of the wind was much below normal.

The rain (4.73) was in excess of any corresponding month during the last twenty years. The nearest approach to it was in 1886, when the March precipitation was 4.44 inches. The least precipitation for March, during my record, was .19 of an inch, occurring in 1885. While there was much rain there were no damaging storms and the earth absorbed a large share of it, supplying a needed want.

The first storm of the month was snow, which was deposited on the 1st, between 6 A. M and 5 P. M., the depth being five inches. Four more inches of snow fell on the 12th, from 3:30 P. M. to well into the night, loading trees, telegraph wires, etc., so that the landscape on the morning of the 13th was a beauty to behold.

*Elkader*—CHARLES REINECKE. Ice in the Turkey broke up and went out at Elkader on March 7th, at 4 P. M. The channel was thawed out before. For the first time since September the precipitation exceeded the average.

*Forest City*—J. A. PETERS. Severest snowstorm of the season on the 27th. Spring work commenced about the 15th, but was delayed on account of the storm of the 27th.

*Galva*—JAY M. CROWLEY. The storm on the 27th left from four to five inches of snow on the level.

*Grand Meadow*—F. L. WILLIAMS. A wonderfully fine display of auro-ras on the 14th and 15th. On the 15th work in the fields began. The month has been marked by extremes of temperature. The early part of the month was warm and pleasant, followed by every kind of weather, delaying farm work. Wheat all sown during the month; more sown than for years.

*Humboldt*—HENRY S. WELLS. High wind on the 14th. March came in like a lamb and went out like a lion. Wheat nearly all sown, and thought to be in good condition. Clover sod being plowed for corn.

#### APRIL.

The mean atmospheric pressure for the month was 30.08 inches. Highest observed, 30.54 on the 6th at Sioux City; lowest, 29.51 at Davenport and Keokuk on the 13th.

The average weather conditions for the month were about normal for April, as shown by the records of Iowa stations. The mean daily temperature, as deduced from the reports of 114 stations, was 48.1°. The highest mean, 53.2°, was reported from Fort Madison; the lowest, 43.8°, at Osage. The extremes of temperature were as follows: Highest, 91° on the 16th at Carroll, Logan, Glenwood, Portsmouth and Ogden; lowest, 14° on the 5th at Rock Rapids.

The average precipitation, as shown by reports from 114 stations, was 2.56 inches, which is about the normal for April in this state. The largest amount was recorded at Moorar, viz., 4.82 inches. Larchwood reported the least amount, being only .27 of an inch. There were 13 clear days, 8 cloudy, and 9 partly cloudy.

#### OBSERVERS' NOTES.

*Amana*—CONRAD SCHADT. The weather, although very cool, was favorable for farming, with moisture enough for good prospects.

*Belknap*—A. W. RANKIN. A cold, wet and backward month. Grass short at close of month, and fruit not in full bloom.



*Bonaparte*—HON. B. R. VALE. The frequency of rains, amounting to 3.71 inches, falling at ten different times, almost precluded seeding and farm work; grass doing well; fall grain backward, but improving.

*Centerville*—GEO. GOODLANDER. Season has been quite favorable for putting in crops. A severe wind on 13th damaged fences and small out-houses.

*Garden Grove*—HON. M. WEMPLE. A good month for all kinds of farm work. Grass backward on account of cold and dry weather. All orchards burdened with bloom, giving fair prospect for fruit.

*Greenfield*—J. G. CULVER. On April 30th plums, peaches and cherries were beginning to bloom; no damage by frost.

*Logan*—MRS. M. B. STERN. Quite a thunderstorm on 30th west of us, with considerable hail.

*Plover*—J. S. SMITH. On the 30th, a tornado passed seven miles west of this station, in a northeasterly direction. A number of buildings were destroyed, and a man and his eight-year-old son were killed. The storm passed about 7 P. M.

*Primghar*—LEWIS CLARKE. On the 30th, a small "cyclone" passed through the west part of O'Brien county, damaging property to some extent.

*Ridgeway*—ARTHUR BETTS. At close of the month grass is green; wheat is up; willows and lilacs are leaved out; early garden vegetables are coming up.

*Sioux City*—U. G. PURSELL. The mean temperature for April during the nine years that observations have been taken here is 51°, but last month it reached only 50°. The highest was on the 16th, when the mercury got up to 88°, and the lowest was on the 5th and 6th, when it went down to 19°. On the 15th there was a spread of 37° between the highest and the lowest, and on the 12th there was a variation of only 7° throughout the twenty-four hours. Notwithstanding the month was below the average in temperature, there is a large excess since New Years, the accumulation being 483°, or an average daily surplus of 4° since the beginning of the year. But most of this was piled up in January and February and early in March, when it couldn't do much good so far as crop-growing is concerned.

The total precipitation during April was only 1.37 inches, whereas the average for the month during the past nine years is 3.26 inches, so it will be seen we have had only about 52 per cent of what we had a right to expect. There has been only one year since the station was established here that there has been less precipitation in April, and that was 1890, when it reached but 1.32 inches. In 1896, it reached 6.16 inches, and last year it was 4.03 inches, both being much above the average. The total deficiency for the first third of the year is 2.94 inches. During the month there were 12 clear days, 8 partly cloudy days and 10 cloudy days. There were 7 days on which the precipitation was more than .01 of an inch.

#### DESTRUCTIVE STORMS, APRIL 30TH.

On the afternoon of April 30th a number of localities in the northwest district were swept by severe windstorms, that displayed some of the characteristics of tornadoes at various points in their pathway. The reports



indicate that the effects of tornadic action were visible, and funnel-shaped clouds were described by numerous observers.

The principal storm originated in northeastern Nebraska and moved in a northeast direction, passing through the southeast corner of South Dakota, causing some damage and loss of life in the latter state. A report from Newcastle, Neb., states that two tornadoes were observed near that place about 4 P. M., creating much havoc to property in that section. Passing thence near Elk Point, S. D., the storm entered Iowa near Chatsworth, in Plymouth county, and moved apparently up Indian creek. The town of Maurice, in Sioux county, at the crossing of the Sioux City & Northern and Chicago & North-Western railways, was directly in the pathway of this branch of the storm, and the place suffered severely, though, happily, no lives were lost. A special from that place to the *Sioux City Journal* says:

This town was visited by a destructive tornado at 4:45 last evening, but no fatalities resulted. The funnel-shaped cloud approached from the southwest. Its fearful roaring gave the citizens ample warning, and most of them had sought refuge in storm caves or cellars when the storm broke in its fury. In the northwestern part of town the most important structures leveled to the ground and totally destroyed are the following: Sioux City & Northern depot; St. Paul & Kansas City Grain Co.'s elevators, valued at about \$2,000, insured. The elevators contained about 1,500 bushels of wheat and the same amount of corn and oats, which will be saved with but little loss. Three cars containing nearly 2,000 bushels of wheat had been loaded and were billed for shipment. These cars were overturned, but the wheat will all be saved, with probably the loss of 100 bushels. The elevator is owned by the Sioux City & Northern railroad and leased by A. D. Thompson & Co. The building is ruined. The dwelling house of J. Nicolay was destroyed with its contents. The residence of C. Van Gorkam, with contents, is a total loss.

The storm moved in a northeasterly course, passing through the southern portion of Sioux and diagonally through O'Brien county, expending its force at Hartley and vicinity. In O'Brien county, a few miles south of Sheldon, two children were killed, and numerous homes were wrecked. Heavy damage to buildings resulted in Hartley. The central line of this storm covered a distance of over eighty miles.

There were evidently a small group of tornadoes, moving on parallel lines, some distance apart, within the belt of disturbance. The little town of Carnes was struck about 4:50 P. M., and badly shattered buildings mark the path of the destroyer.

While the storm above described was sweeping through the counties of Plymouth, Sioux and O'Brien, a similar disturbance passed on a parallel line, southwest to northeast, through the northern part of Monona (near Whiting), the southeastern part of Woodbury, across a corner of Ida and through a portion of Buena Vista county. Much damage was wrought by this branch of the same general storm. A special from Oto to the *Sioux City Journal* said:

The storm commenced about 4:45 P. M., with a terrific rain and hail, and at 5:15 the dreaded funnel cloud was seen to be forming about a mile southeast of here, causing much alarm, carrying away small houses and overthrowing those somewhat larger, and moving even the largest buildings in its path.

The following description of the storm in Buena Vista county is furnished by David E. Hadden, voluntary observer at Alta. Mr. Hadden writes:

A severe windstorm, which assumed some of the characteristics of a tornado, passed through a portion of Maple Valley and Nokomis townships, Buena Vista county, in the late afternoon of April 30th, which resulted in considerable damage to barns, sheds and other farm buildings. The sky was nearly overcast all forenoon, and partly cloudy in the afternoon of the 30th, with a brisk south to southwest wind. About 4:30 P. M. heavy clouds were observed in the southwest, with occasional murmurings of thunder. About 5 P. M. rain began, with some hail. This continued until 5:40 P. M., when rain and wind momentarily ceased, and heavy hail from one-half to two inches in diameter began falling, lasting about five or six minutes. Just at this moment I observed the clouds, which were rather low, about two miles south of town, revolving quite rapidly (horizontally), and at intervals the suggestion of a funnel cloud would form about half way from the cloud to the ground, then quickly disperse, and again form and disperse. This was repeated several times, but at no time could the cloud be seen to reach to the ground. I remarked to neighbors at the time that in all probability a tornado had just passed south of us. At 5:45 P. M. the wind suddenly ceased, but in a few minutes changed to the northeast, then north and brisk northwest, accompanied by a very heavy rain, which continued until about 6:30 P. M.

No lives were lost or persons injured. But little electric disturbance was noted. About three-fourths of the hailstones were of the size of large marbles, and the rest were one to two inches in diameter. The location of debris at each farm proves that the storm was of the tornado type.

It seems providential that so few casualties resulted from the numerous tornadic storms that swept across our state on that closing afternoon in April.

#### MAY.

The mean pressure for May was 29.92 inches. The highest observed was 30.30 inches at Cresco on the 4th; lowest, 29.49 inches at Davenport and Dubuque on the 27th.

The mean temperature for the month of May, as deduced from the records at 114 stations, was 59.6°, which is about the normal for the state. Keokuk reports the highest monthly mean, 64°; and Rock Rapids the lowest, 55°. The highest temperature reported was 92° at Odebolt and College Springs, on the 24th and 25th; the lowest was 26° at Rock Rapids, on the 6th.

The average rainfall for the state, as deduced from records of 114 stations, was 4.67 inches, which is a little above the state normal for May. Fort Madison reported the heaviest measurement for the month, 7.82 inches. The least amount was 2.22 inches, at Estherville. Clear Lake reported a fall of 3.73 inches on the 21st. For the state there were 9 clear days, 12 cloudy, and 10 partly cloudy.

#### OBSERVERS' NOTES.

*Amana*—CONRAD SCHADT. The weather during the month was very favorable for all crops and for farming generally. There is as fine a prospect as there ever was.

*Belknap*—A. W. RANKIN. An unusual amount of hail, thunder and lightning has characterized the month of May.

*Bonaparte*—B. R. VALE. Sixteen rainy days, giving 6.11 inches. Not to exceed a week's work in fields during month; 14.80 inches rain since March 1st; exceeds any year since 1892, which gave 15.90 in same time.

*Carroll*—MOSES SIMON. A fine month; no frosts; plenty of moisture and very favorable for outdoor work and the growing crops. Small fruit will be plenty.

*Centerville*—GEORGE GOODLANDER. Crops doing well. All kinds of fruit coming nicely.

*Clinton*—LUKE ROBERTS. No damage from frost. No damage from storms, except the destructive tornado on the 18th, which passed through a portion of the north part of the county, that was very destructive. On the whole, May was a very fine month.

*Grand Meadow*—F. L. WILLIAMS. May 7th, corn planting begun. Plums and apples in bloom, 10th to 13th.

*Humboldt*—H. S. WELLS. Wheat and small grain good; very little replanting corn; grass unusually good; fruit prospects never better.

*Iowa City*—MRS. C. M. HOBBY. Heavy rain and hailstorm on 19th. Cat birds and golden robins announced their presence May 1st.

*Lamoni*—T. J. FITZPATRICK. On evening of the 18th hail fell in quantity, many stones measuring over half an inch.

*Larchwood*—F. W. STOKES. First thunderstorm of the season on the 17th; a severe windstorm passed just east of town at 4 P. M. of that day, doing some damage to small buildings.

*Logan*—MRS. M. B. STERN. Had three thunderstorms during month; one on 19th quite severe; one woman in Logan badly shocked but has recovered; weather cloudy and damp; not much damage from heavy rains.

*Maquoketa*—Dr. A. B. BOWEN. On afternoon of the 18th a tornado passed about five miles south of this city, causing much destruction to life and property.

*Marshalltown*—C. M. COOK. Hail fell from 1:15 to 1:20 P. M. on the 18th; largest stones 1 inch, and average size half inch in diameter.

*Mason City*—B. F. GIBBS. In half a century of farm life have never seen crops look better than at the close of May.

*Mt. Ayr*—A. F. BEARD. Hail on 18th broke quite a number of window glass in town; a windstorm struck the fair grounds on the 20th, wrecking some of the buildings there.

*Olin*—HON. NATHAN POTTER. On the 18th, at 3 P. M., hailstones fell 9 inches in circumference, the largest weighing 4 ounces; no wind accompanying the storm.

*Ridgeway*—ARTHUR BETTS. A good month; vegetation wonderfully advanced; some pretty mirages on four rates, elevating distances and making queer deceptions; gale on 27th and a cloudburst two miles away, an awful downpour.

#### MAY'S DESTRUCTIVE STORMS.

Though the elements were generally propitious throughout the state, yet the month of May brought its full quota of destructive windstorms; but, happily, their desolating effects were limited to a narrow pathway through four or five counties. The most severe storms of the month occurred on the 17th and 18th.

A wind and hailstorm on the evening of the 17th swept through a portion of Ringgold county, and reports indicate that it assumed the form and force of a tornado in Clinton, Benton and Rice townships. The storm was undoubtedly a continuation of the tornadic disturbance that swept through the southeastern counties of Nebraska, earlier in the afternoon of the same day. It passed near Maloy, a station on the Chicago Great Western railway, but fortunately it was deflected before reaching that place, and no

lives were lost, though the destruction of farm property amounted to several thousand dollars. Three persons were injured, one of them quite seriously.

The Mt. Ayr News says it was a genuine tornado, its revolving motion being observed by large numbers of people.

It started in Missouri, about 5:30 P. M. at a point about four miles south of Blockton, moving thence northeast, in the direction of Maloy. The path of the tornado, according to the *Record*, was over ten miles long and 200 yards wide.

Though it did not strike Maloy, yet it passed sufficiently close to lift a portion of the roof of the railway depot and to move buildings from their foundations, turning them partly around. Farm residences, barns, sheds, outhouses and timber lots suffered considerably. Fortunately, a considerable portion of the loss of buildings will be covered by insurance. The storm may be classed among the minor disturbances. In Mt. Ayr there was a heavy shower accompanied by hail and a strong wind. On the same date there were heavy local showers in the south central counties.

#### TORNADO MAY 18TH.

On the evening of the 18th a tornado originated near Stanwood, between 3 and 4 o'clock P. M., and moved in a direction north of east, traversing the northern portion of Cedar county, the northwestern part of Clinton county and the southeastern part of Jackson county, crossing the Mississippi river near Sabula, and thence sweeping through a portion of Illinois, in which state there was heavy damage and some loss of life. It was altogether the worst storm of the kind that has visited Iowa since the Pomeroy tornado on July 6, 1893. Its entire course was through prosperous farming districts; but fortunately it missed the populous towns in that section, else the loss of life would have been fearfully large. The fatalities reported in this state were nineteen, and more than double that number were injured more or less severely. The loss of property was very heavy, being variously estimated at three to four hundred thousand dollars.

The day was warm and the weather conditions were threatening. A well-defined cyclone was passing through the upper Mississippi valley, the storm center being near St. Paul at 7 P. M. The morning forecast for Iowa gave warning of "showers and probably severe thunderstorms in the east portion in the afternoon or night." The day has been described by weather observers as "a regular tornado breeder."

The first appearance of the tornado was observed in the vicinity of Stanwood, and James G. McKerron of that place gives the following report. He says: "On the 18th the air seemed oppressive up to about 2 P. M., and then a heavy thunderstorm came from the southeast. About 3 o'clock it began to hail, the stones varying in size from size of hickory nuts to walnuts, and two miles north and west the hailstones were much larger. At 2:30 P. M., a heavy cloud was noticed coming from the southwest, the lower part of the mass appearing to be 200 to 300 feet above the earth. When it reached a point one mile south, it formed a funnel, and a part of the cloud shaped like an elephant's trunk darted downward, striking the buildings of James K. Davidson. The main cloud seemed to move in a northeasterly direction, but the part that struck the ground would swing round, making

a zigzag track. The funnel united with the thunderstorm when it was about two miles east of this place, becoming very black, and showing a rotary motion, the whirling being from right to left. It followed very closely the track of tornadoes reported to have passed through this section several years ago. There was no loss of life near this place, but several miles east a number of people were killed. Much damage was done to buildings and stock that happened to be in its path. The amount cannot now be estimated." Newspaper reports accord with Mr. McKerron's description of the storm as it appeared near Stanwood.

□ The storm crossed the track of the Chicago & North-Western railroad between Stanwood and Clarence, and swept through the townships of Dayton and Massillon in Cedar county. It missed the town of Clarence by about eighty rods. Crossing the Davenport branch of the Chicago, Milwaukee & St. Paul railway about half way between Massillon station and Oxford Junction, the storm swept eastward through the corners of Clinton and Jackson counties. In its course it closely brushed the towns of Lost Nation, Elwood, Delmar, Riggs, Brown, Preston, Miles and Sabula. It seems miraculous that it did not hit some of these places when passing so near to their outskirts.

Mr. J. E. Gilroy, of Lost Nation, describes the storm as it appeared in that vicinity: "The storm appeared at 3:40 P. M., and was small when first seen in the southwest. It was moving in a direct line toward this town, nearly due east. It destroyed the residence of F. P. Welch and a school-house sixty rods north of his place. The Welch family saved their lives by fleeing to the cellar, and other families near there were saved in the same way. In Sharon township it destroyed the homes and property of Peter McAndrews and Maurice Wolf. No lives were lost in this vicinity, but destruction of live stock was large. Further east the people suffered more, and many were killed. Many curious incidents could be related, such as picking chickens and wrapping barbed wire around stock. No rain came with the tornado, but a heavy shower fell about three hours later."

The storm reached the vicinity of Elwood, five miles east of Lost Nation, at about 4 P. M. S. H. Clark, postmaster of that place, sends a description, from which we make the following extracts: "A funnel-shaped cloud appeared in the southwest a few minutes before 4 o'clock, and passed Elwood at 4. It struck Brookfield township near the southwest corner, and moved east by north, crossing the east line near the center. For want of a name we call it a 'Kansas twister.' In its track there was not much left worth picking up. In this township there were three hundred head of cattle killed, also four to five hundred hogs, mostly pigs. William Ruggles was cleared of everything in the shape of buildings, and his loss is estimated at \$7,000. George Teskey's buildings, fences, and most of his stock were swept away. Among the heavy losers were C. C. Ruus, R. Claus, H. H. Hicks, John Severine, J. A. Hines, E. A. Coverdale, and William Cook. Every tree in the track of the storm appears to be twisted from the roots, the bark all gone. Lumber, buildings, and fences were broken into kindling wood."

George G. Holcomb, postmaster of Riggs, Waterford township, writes that the tornado reached that vicinity at 4:30 P. M., and destroyed everything in its pathway in the farming district, except the crops, which were slightly damaged. When the funnel appeared it seemed to draw every

cloud near by into the core of the storm. It appeared very black and clouds twisted in every direction. There was some hail about ten or fifteen minutes before it came, with but little rain.

The storm passed about a mile and a half south of Preston, Jackson county, sweeping eastward nearly on the Clinton county line. Postmaster J. W. Campbell, of that place, in his report kindly furnished this office, says the storm could be seen for more than an hour in the southwest before it reached the vicinity of Preston. Its general appearance was funnel-shaped, and from the cloud there was an appendage of a long point or tail, which was swaying with a whirling motion. Five lives were lost, Mr. and Mrs. Charles Flora and three children, comprising their whole family, at a place about two miles south of Preston. In the vicinity of Preston, within five miles each way, the property loss will amount to nearly, if not quite, \$50,000.

The *Preston Times* says the storm passed that place about 4:30 P. M. To this it adds:

The afternoon had been sultry and a storm was expected to result, but an idea of the devastating effects which followed was hardly thought of. When the darkening clouds first appeared many hurried to their homes expecting only a heavy rain, but the heavy black, swirling mass of cloud which appeared in the southwest, quickly warned the citizens what to expect, and the direction in which it was moving, when first seen, made many feel that Preston was to feel the devastating effects of a tornado. A short time previous to its approach a message from Lost Nation stated that a cyclone had passed over that place going eastward, and the time taken in traveling the distance between the two places was about an hour and twenty minutes. There was little or no rainfall within the scope of the cloud, but after the storm immense hailstones were picked up in Preston, some measuring twelve to fourteen inches in circumference.

Albert Durant, of Preston, sends the following report of the storm in that section:

The first appearance of the storm was a narrow strip of black cloud reaching from the clouds above to the horizon, slightly to the southwest; but it did not reach this vicinity for over an hour after. The distance near here that the destruction was complete is about seven miles; trees, buildings, fences and stock were entirely destroyed or killed in its track. Most of that distance is in Clinton county, just south of our county line, but came into Van Buren township for about one mile. It passed about one and one-half miles south of Preston. Fourteen farm places lay in its track. The damage is not less than \$50,000. It was the most severe storm that has ever passed through here. Considerable hail followed the tornado. The cloud as it approached was funnel-shaped, and had a whirling motion, and traveled in its course rather slowly. Very little rain fell with the storm. It struck the ground about five miles west of Preston and did not raise again until about two miles east.

The storm was observed at the city of Maquoketa, about six miles north of its track. The *Excelsior* of that place says:

This terrible instrument of destruction was seen by many in the south part of this city and is described as the usual funnel-shaped cloud, but not moving very fast. Its course was from west to east, and it apparently followed the line of the Chicago, Milwaukee & St. Paul railway, going along about a mile south of it. The power of this death-dealing twister was tremendous. Trees were uprooted, large groves of them were stripped down to nothing but their trunks; horses, cattle and hogs carried like straw for three-quarters of a mile or so much further that their owners cannot find them; houses, barns, outbuildings blown no one knows where; green



trees stripped of their foliage and even bark, fences gone, people killed or seriously injured, others with their faces driven full of dirt, tell partially of the immense amount of damage done in a strip about a quarter of a mile in width. One of the most remarkable features of the storm was the slowness with which it traveled. It was an hour and twenty minutes traveling from Lost Nation to Preston, a distance of about twenty-five or thirty miles. From Elwood to Delmar a freight train easily ran ahead of it.

Beyond Preston the pathway of the storm was not well defined, but it is known that it crossed the Mississippi river between Sabula and Elk Junction, and reports indicate considerable loss of life and destruction of property in Illinois. The distance traversed in Iowa was about fifty miles, but in that distance there were considerable intervals wherein the damage was relatively slight. It appears to have skipped and swayed from side to side, making a zigzag pathway, but its general course was about as direct as the flight of an arrow. The track varied in width from a hundred yards to about a quarter of a mile.

Though it revolved swiftly on its axis, its progressive movement to the eastward was remarkably slow. Warnings were sent on ahead from town to town near its track, furnishing a new basis for the theory that it is possible to establish a system of signals whereby the people may be warned of the approach of that class of destroyers.

The following list of names of persons killed by the storm is copied from a press special, and is probably correct:

Near Riggs' Junction: Michael Hines, Maggie Maloney, James Maloney, Rose Maloney, Mary Call.

Near Delmar: Oba Allison, Pat Hines, Sauren Clemensen, two children of Francis Allison, A. D. Hildebrand, William Grieme.

Near Preston: Charles Flora, Mrs. Charles Flora, three Flora children.

Near Quigley: William O'Meara, child of John Clark.

It is wholly impracticable to compile a list of the persons injured and the losses of property.

The following paragraph is clipped from the *Clinton Herald*:

The steamer *Saturn*, which was going down the river with a raft, had a very narrow escape. The storm struck her about two miles below Sabula. Capt. W. A. Krotka was seen by a *Herald* reporter this afternoon, and told the experience of the *Saturn*. He said the boat was anchored near Sabula when he saw the storm coming. He moved down the stream in order to keep from being blown into the bridge. He says he watched the clouds closely and saw one from the southeast approaching one from the northwest. They met just over the hill near Sabula and took an easterly direction. Captain Krotka said there was no whirling motion until the clouds came in contact. He saw the storm coming directly toward him, and thought the boat would surely be lost. When the cyclone was within a few rods of the *Saturn*, Mr. Krotka says a fierce wind from the south struck the approaching storm and turned its course enough so that the full force just missed the boat. However, it did not fully escape, and when struck by the wind turned nearly over. He says the engine-room had a foot of water in it when the boat righted itself. During this time Captain Krotka was struck on the head with a board from the pilot-house, and Mate Eugene Clark was injured by a line breaking.

While the storm was passing over, the crew say they saw some animal, either a cow or horse, in the cloud.

George Nevitt, who came down the river last evening on the steamer *Cyclone* with a raft, and was near Sabula when the storm passed, gave a vivid description of what he witnessed. He says that they were in the wake of the storm and had a fine view of it as it passed over the river. The

air was filled with timbers and trees. Large limbs would float through the air like parachutes and gradually settle to the ground. One board, ten feet long, fell upon the forecastle of the boat and penetrated through the floor. Hail fell in great quantities, chunks being found as large as a man's fist. The barrels on deck were filled with the ice.

Mr. Nevitt says that an island opposite what is known as Dark Schute was completely stripped of its growth of timber. On the banks of the river, where the storm crossed, the timber was torn down to a width of at least 700 feet.

#### A SMALL TORNADO MAY 31ST.

The Grinnell *Herald*, in its issue of June 2d, under the caption "Wild Wind," reported a small tornado dropping down in Washington and Grinnell townships, Poweshiek county, on the evening of May 31st. The *Herald* said:

"A number of people, about 6:30 Tuesday night, observed a funnel-shaped cloud plowing its way through the air in a northeasterly direction, southeast of town. The roaring was distinctly heard a distance of two miles, and a good many cool heads along the track of the storm took to cellars for safety. It seemed to be above the ground, and to most people who saw it, it meant nothing but an aerial tornado, ugly enough looking, but too high in the air to be dangerous. It was a more serious matter, however, to two families along its track, where it settled to the ground and performed the usual pranks attributed to such storms, destroying everything in its path, uprooting trees, and crushing in its mighty force large buildings to the ground.

"The unfortunate homes in the path of the storm were L. P. Spooner's and C. A. Ratcliffe's, the one south and the other east of Maple Grove schoolhouse.

"Mr. Spooner had just risen from supper, and, chancing to step to the south door, he saw a funnel-shaped cloud in the air about a mile and a half to the southwest. He quickly closed the house, and with the other members of the family went to the cellar. The storm seemed to come slowly, striking first the north end of G. F. Hyde's grove, a few rods south of Mr. Spooner's residence. It then swept through Mr. Spooner's orchard, uprooting large trees, overturning his apiary, striking the house with such force as to unshingle a portion of it, knock out nearly all the windows, and fill it with dirt and water. The windmill was demolished, corncribs unroofed, whole sections being torn from the cribs, and the large barn and other buildings were crushed and scattered in piles on the ground.

"The center of the storm here seems to have been just east of the house, with the west swirl of the wind going southward. Seven horses were in the barn, and strange to say none were injured, although the timbers fell all around them and on them. Only three small pigs were killed for Mr. Spooner. Mr. Spooner at once came from the cellar and watched the storm swing northeasterly, but as it stopped in English bottom and seemed to be turning back, he wisely took to the cellar again.

"At C. A. Ratcliffe's, one-half mile north of Mr. Spooner's, Mr. Ratcliffe's attention was first called to the storm by the slamming of his barn door, where he was at work. He at once noted the cloud at Mr. Hyde's grove, and so smoky and fiery did it appear, that he thought Mr. Hyde's house was on fire. He started to give orders to go and help Mr. Hyde, but



the onward sweep of the storm and the flying of the timbers at Mr. Spooner's showed him a cyclone was coming, and with his family he went to the cellar. The center of the storm seemed east of the house, on the east uprooting trees at Mr. F. F. Lee's, a few rods from Mr. Ratcliffe's, and unroofing his corncrib. At Mr. Ratcliffe's his windmill, stables, large hay barn, 108x64 feet, went down—in fact everything but his house and one smaller building. Windows in the house were broken and the roof unshingled. Though there were eight horses in the stable and a dozen head of cattle close by, none were injured except one calf was killed. Here, too, the west side of the storm carried debris south, and ruins of the hay barn northeast of the house were left in the yard by the house. Mr. Ratcliffe came out of the cellar as soon as the storm had passed, but had the same experience as Mr. Spooner when he saw the cloud stop and appear about to take a backward swing.

"It is hardly necessary to describe to Grinnell people the fury and destruction of such a storm. Everything in its path was crushed, and the debris was scattered in all conceivable directions.

#### JUNE.

The mean pressure was 29.93 inches; highest observed, 30.28 inches, at Dubuque and Cresco, on the 15th; lowest, 29.47 inches, at the same places, on 24th and 25th.

The month of June was slightly warmer than usual, with an excess of moisture. The mean temperature for the state was 71.4°, which is about 1° above the normal. The average of the north section (a belt three counties in width across the state east and west), was 69.7°; central section, 71.3°; southern section, 72.9°. Fort Madison recorded the highest mean, 76.1°, and the lowest, 67.6°, was recorded at Cresco and Grand Meadow. The maximum reported was 99°, at Belle Plaine, on the 30th.

The average rainfall for the state was 4.72 inches, which is slightly above the normal for June. The averages by sections were as follows: Northern section, 4.36 inches; central section, 4.47 inches; southern section, 5.29 inches. The maximum amount recorded for the month was 12.48 inches, at Greenfield, Adair county; minimum amount, 1.90 inches, at Olin, Jones county. At Greenfield 7.21 inches fell on the 9th. The greater amount of the rainfall came in the first half of the month; the latter half being generally dry and favorable for farm work. There were 13 clear days, 10 partly cloudy and 7 cloudy.

#### OBSERVERS' NOTES.

*Amana*—CONRAD SCHADT. With the close of June we have just entered the harvest season of small grain. Rye is being cut and winter wheat is ripe for the reaper. Barley, spring wheat and oats will follow soon. It will be an extraordinary good crop, as was also hay. Corn and potatoes are in the best condition; in fact there hardly ever was a season when all crops together looked better than they do now.

*Atlantic*—HON. J. W. LOVE. Severe thunderstorm on the morning of the 22d; very hard rain with some hail; reported damage to crops considerable.

*Bonaparte*—HON. B. R. VALE. An unprecedented wet month; 9.01 inches of rainfall. This beats any one month since 1890, by 1.47 inches, and

it beats the year 1892 to date, by 3.17 inches. We have had 27.37 inches rainfall since January 1st, which is .40 more than all last year.

*Charles City*—IDA SCHOTT. June 25th cyclone-shaped clouds formed which gradually grew wider; wind blew very hard with heavy rain and sharp lightning.

*Dows*—R. E. FULLER. Small cyclone twenty miles northwest of here on the 18th, did considerable damage.

*Forest City*—J. A. PETERS. A windstorm on the morning of the 24th did considerable damage to trees and growing crops. It was a straight blow. Greatest precipitation of any one month since the establishment of this station, 1894.

*Humboldt*—HENRY S. WELLS. This month has been wonderful for growth of all crops. Corn is king. Haying is three weeks early.

*Larrabee*—H. B. STREVER. Windstorm on the 24th did slight damage to crops. June has been an ideal month for vegetation.

*Primghar*—P. R. BAILEY. Severe hailstorm on the morning of the 30th, destroying crops in central and south central part of county.

*Thurman*—C. R. PAUL. Heaviest electric and rainstorm ever experienced here, noon to 2:20 P. M., June 6th.

*Clinton*—DR. LUKE ROBERTS. June, 1898, was exceptionally fine in all respects. The fruitage of the soil seems never to have presented a more gratifying outlook for a generous ingathering than was apparent at the close of the month.

Temperature, sunshine and moisture were harmoniously blended—the winds were on good behavior, and the storms and atmospheric electricity were very moderate, except one extraordinary downpour on the 13th, which was entirely local, and covering not more than six or eight square miles. This storm precipitated 4.61 inches of water in three hours, and while the people were in bed and not aware of the flood formation going on around them until they opened the doors in the morning and found submerged gardens, floating sidewalks, and navigable streets and alleys.

This storm caused an increase in the monthly aggregate of precipitation above normal. The rainfall for the month was 8.02 inches, normal being 4.73 inches. Three Junes during the last twenty years have exceeded this; viz: 1881, 8.17 inches; 1882, 8.97 inches; 1892, 9.39 inches.

#### JULY.

The mean pressure of the atmosphere was 30 inches. The highest observed was 30.26 inches, at Cresco and Dubuque, on the 12th; lowest, 29.50 inches at Clarinda, on the 19th.

The month was seasonable in its average temperature. The average temperature of the northern section (three counties in width across the state) was 72.1°; central section, 73.6°; southern section, 74.6°; average for the state, 73.4°, or about the normal for July. The highest temperature reported was 102°, at Clarinda on the 19th and at Rock Rapids on the 24th. The average range of temperature for the month was 45.5°.

The average precipitation of the state was 2.98 inches, which is a little below the normal amount for July. The averages by sections were as follows: Northern section, 3.02 inches; central section, 2.10 inches; southern section, 3.83 inches. The central belt suffered most from the effects of

the drouth, which continued with slight abatement from the 8th to the 27th. A large share of the rainfall fell in the last four days of the month. The records show the heaviest rainfall for the month in the extreme southwest, in a portion of Fremont county. The station at Thurman recorded a total of 12.88 inches, of which amount 9.70 inches fell on the 6th and 7th. At Sidney the records show 9.90 inches for the month, the fall on the 6th being 6 inches.

Dubuque reported the highest velocity of wind, 56 miles per hour, on the 19th. There was an average of 19 clear days, 9 partly cloudy and 3 cloudy.

#### OBSERVERS' NOTES.

*Britt*—GEO. P. HARDWICK. High wind 1st and 17th. Hail north of station on 19th, doing some damage to grain.

*Dows*—R. E. FULLER. On the morning of the 19th hail as large as hens, eggs fell two and a half miles northwest of the station.

*Forest City*—J. A. PETERS. Wind on night of 26th lodged grain badly in places.

*Humboldt*—HENRY S. WELLS. Corn, potatoes and pastures have suffered from drouth. Hay and harvest have been gathered in the best of shape.

*Amana*—C. SCHADT. The severest storm for many years occurred on the evening of the 19th. Trees were broken and uprooted, windmills wrecked and all the shocks in the field blown down, and about half the apples torn from the trees.

*Greenfield*—J. G. CULVER. A severe storm of wind on the 19th. Many hay stacks blown over; oats and corn suffered considerable damage; trees broken and injured. In the neighborhood of Orient and Spaulding many cribs and light buildings were injured and some destroyed. The windmill owned by the Chicago, Burlington & Quincy, at Orient, was wrecked and the tower blown over.

*Sigourney*—MRS. R. F. ASHBAUGH. On the night of the 2d there was a bright rainbow in the north about 2 A. M. The moon was full and shining bright in the southern sky, while raining far north. Was witnessed by several reliable men.

*Thurman*—C. R. PAUL. A severe rainstorm, which assumed some of the characteristics of a waterspout, passed through this section on the night of the 6th and morning of the 7th, with 9.70 inches of rain.

*Bonaparte*—B. R. VALE. A cool but seasonable month. No severe storms or extremes in temperature. Rains have been opportune, but not in excess of the need.

#### A SEVERE JULY WINDSTORM.

The month of July brought its full quota of severe windstorms, with some local manifestations of tornadic force. The most severe and destructive windstorms occurred on the 19th and 27th, detailed reports of which have been received in form of newspaper clippings and observers' notes.

On the afternoon and evening of the 19th, wind squalls of considerable severity swept across more than two-thirds of the state, the central line of greatest disturbance extending from the southwest through the central and across the northeast districts, and covering a very wide belt on both sides of the line. The maximum velocity of the wind at the Des Moines station

was forty-five miles per hour, but the reports of the damaging effects indicate that a higher velocity was reached at numerous other localities.

The duration was short, and the amount of rainfall was generally light. The storm was accompanied by sharp lightning, and in the northern part of the belt some hail fell in scattered localities. The storm was quite destructive to light buildings, windmills, shade and fruit trees, hay and grain stacks and grain in shocks; and probably the aggregate of damage would make quite an astonishing figure. The insurance companies that cover hazards of that character report numerous losses in all the sections visited by the storm. The character of the storm was that of the ordinary summer squall—a straight blow, with no evidence of tornadic action.

The severest storm of the month, though happily confined to a small area, occurred on the evening of the 27th, extending over portions of the southwest and south central districts. In the central part of the disturbance a small tornado developed and passed through a narrow strip in the eastern part of Mills county and the western part of Montgomery county. The following brief description is from Observer D. B. Nims, of Emerson, Mills county:

On the afternoon of July 27th a tornado formed about two miles northwest of Emerson and moved in a direction east by southeast. It passed about one mile north of Emerson, but its effect was felt strongly in the north portion of the town in the breaking down of shade trees and shattering various buildings. In the path of the storm all buildings were destroyed, orchards and shade trees were uprooted or twisted into splinters. Whole fields of small grain were blown away, and one group of stacks was blown entirely away, with not a straw remaining to show where it stood. Mrs. Thornton and her little child were involved in the destruction of their home and killed. Three other children were injured, one seriously. Several persons narrowly escaped death. Twenty head of fat steers, feeding in a pasture, were killed, some of them being lifted and blown from ten to forty rods. Crops in the path of the storm were entirely destroyed, and in adjacent fields stacks were blown into shapeless heaps. The storm traversed a distance of about five miles, and was from twenty to sixty rods in width. It increased in violence until it finally spent its force or was lifted into the air. All who took refuge in cellars or caves escaped injury.

The Emerson *Chronicle* gave some interesting details in relation to the storm. Its pathway was through the cemetery of the town, and about sixty monuments were blown down and many of them broken.

The Red Oak *Express* of July 29th published many items of interest in relation to the effects of the storm in Montgomery county. It says the tornado appears to have originated in the eastern part of Mills county. Its path was not over eighty rods wide, but the destruction in these limits was heartrending. Its course was directly towards Red Oak, but was lifted before reaching that place, which only felt the force of a heavy, straight blow. Twelve farm houses and barns were totally destroyed, and the total loss of property amounted to many thousands of dollars. The *Express* says: "All the vagaries of a tornado were present. Chickens had their feathers blown off and walked about in their nakedness." Outside of the direct path of the storm lightning was doing its work of destruction, and numerous reports of losses of buildings and stock are made in that section. About 2:30 in the afternoon of the 27th, William R. Penry, residing about eight miles northeast of Red Oak, was struck by lightning and instantly killed. A church near Wallin was struck and burned.

The *Glenwood Tribune* says the storm seems to have started in Indian Creek township, where it destroyed some buildings and took off the top of the Nishnabotna bridge near Hastings. It further says: "Like the majority of tornadoes, its actions and appearances were most peculiar. It went in streaks and by jumps, and did its deadly work in the main by means of twists, everything that came into the grasp of these singular vortices being wrenched into a shapeless mass, whether it be iron or flesh. The storm was accompanied by a dull, heavy roaring, which could be heard for twenty-five miles around, and struck terror to the hearts of all listening, whether they were in the track of the storm or not."

#### AUGUST.

The mean pressure for August was 29.94 inches; highest observed, 30.18 inches, at Cresco on the 9th; lowest, 29.63 inches, at Omaha on the 22d.

The first half of the month was cooler than usual, and during the most of the last half it was unseasonably warm, the mean temperature for the state being 71.2°, as shown by the records of 110 stations. The mean for the northern section was 67.8°; central section, 71.6°; southern section, 74.3°. The average was therefore about normal. The maximum temperature reported was 103°, at Clarinda and Council Bluffs on the 20th, and the lowest was 40°, at Britt on the 1st. There was an average monthly range of 47.4°.

The average precipitation for the state was 3.44 inches, as shown by the records of 118 stations. This amount is slightly above the average of recent years. The distribution was very unequal, the lowest amount reported being .58 of an inch, at Adair, and the largest total 10.56 inches, at Bonaparte. The averages by districts were as follows: Northern district, 3.43 inches; central, 3.71 inches; southern, 3.17 inches.

The average number of clear days was 17; partly cloudy, 9; cloudy 5.

#### OBSERVERS' NOTES.

*Bonaparte*—HON. B. R. VALE. Rainfall, 10.55 inches; for the year up to date, 41.14 inches, which exceeds any since this office kept a record. Very warm at close of month.

*Britt*—GEORGE P. HARDWICK. Electrical storm night of the 19th, with high winds blowing down corn and other crops. Some live stock killed by lightning.

*Centerville*—GEORGE GOODLANDER. No severe storms except heavy rain on the 7th. If weather continues warm corn will do well.

*Clinton*—LUKE ROBERTS. The heavy rain of the 15th and 16th was accompanied by terrific thunder and lightning, doing damage in many places. Rainfall was much above normal.

*Cresco*—GREGORY MARSHALL. The month ends very hot and dry; pastures are burned up, grass seeding is killed, and corn, which was quite promising, is reduced by 25 per cent. Rainfall has been below average for past four months.

*Forest City*—J. A. PETERS. Very wet month for August. Ground in splendid condition for plowing. Corn will be out of danger of frost by September 10th to 15th.

*Humboldt*—HENRY S. WELLS. A portion of the corn badly blown down. Hay and grain well secured. Corn has matured rapidly the past ten days.

*Logan.*—MRS. M. B. STERN. The month has been very dry and hot. Hot winds one day.

*West Bend.*—PHIL. DORWEILER. A pleasant month. The first half rather cool. Small grain yielding above the average.

*Clinton.*—DR. LUKE ROBERTS. August, 1898, an exceptionally enjoyable summer month, had, so to speak, a marked individualism as compared with the same month in any of the last twenty years, where the normal precipitation was 2.84 inches, while in August, 1898, it was 7.87 inches, being 5.03 inches in excess of normal, and greater than any August except that of 1885, when the precipitation was 10.02 inches, or 2.15 inches more than that of 1898.

There were nine days on which rain fell. In the storm which commenced on the 15th, .45 of an inch of water fell in the morning before 6 o'clock; then at 6:40 P. M. a severe storm set in, lasting until 4:45 A. M. the 16th, and precipitated 3.01 inches of water, making 3.46 inches in about twenty-four hours. This downpour was accompanied by a frightful and terrorizing electric storm, the lightning doing damage in many places.

A storm similar, but of somewhat less severity, occurred on the evening of the 23d, between 5:50 and 8 o'clock, leaving two inches of water.

#### AUGUST STORMS.

Though August is usually the mildest period of the year in this region, the month of August, 1898, brought severe wind and hailstorms, with violent electric disturbance, extending over considerable areas of the state.

On the evening of the 16th a windstorm of much force passed through the country east of Fairbank, near the line of Buchanan and Fayette counties. The *Waterloo Reporter* describes the storm as a "cyclone" (tornado) though the reports do not show the usual effects of a genuine funnel-shaped storm. The destruction of buildings and crops was quite heavy within the limited area over which it passed. Six or seven houses and other farm buildings were razed or badly damaged within a short distance of the place where the storm began. No human lives were lost, but several horses and other stock were killed.

The most widely extended and destructive windstorm of the month occurred on the evening of the 19th. The disturbance was widespread, showing its destructive force at numerous points in the northwestern part of the state, and extending as far south as the main line of the Northwestern railway. Within this wide belt there were many local wind-squalls of much severity, and considerable destruction by hail and lightning. The greatest destruction by hail occurred within an area of 10 miles wide and 15 to 20 miles long, covering most of the distance between Spencer and Emmetsburg. The corn crop in that area was almost totally ruined, and other crops suffered great damage.

At Spirit Lake and vicinity the windstorm is described as the worst that ever visited that region, with a total rainfall of 3.50 inches. The local papers contained reports of losses and damage to prominent buildings, showing a very heavy aggregate of loss resulting from the storm at that point. Windows were broken by hail, houses and other buildings were unroofed by wind, telegraph and telephone poles were prostrated, summer cottages about the lakes were wrecked and trees were broken or uprooted.



At Milford, Arnold's Park, Monument Park, Superior, West Bend, Estherville, and other localities in that section the storm caused a great amount of damage and aroused much terror among the people. The following extract from the *Estherville Republican* gives a vivid idea of the nature of the disturbance:

Friday was one of the most sultry days of this month and all day it seemed to indicate a storm, but not one of such severity as came. About 6 o'clock in the evening it began to sprinkle a little and the distant rumble of thunder could be heard in the northwest. No one expected anything more than a severe thunderstorm. At about 7:30, however, the wind suddenly turned to the northwest and north and blew a terrific gale for fully one hour, accompanied by some hail and the heaviest downpour of water that has visited this section for years. It was almost a waterspout. The strongest buildings creaked from the force of wind and several large windows about town were blown in and the apartments flooded. In the country great havoc was done generally to corn and flax fields and grain stacks, and hardly a windmill was left standing. In several places the roofs of barns were blown off. West of Estherville, and particularly at Spirit Lake, the storm was a great deal more destructive. Several cottages were wrecked, one residence was blown to pieces, the roof of the Crandall House was blown off, half of the sanitarium was smashed into kindling wood, the restaurant west of the Hotel Orleans was taken up bodily and carried across the railroad track and completely torn to pieces, the Moran boathouse was demolished, the railroad tank badly damaged and about half of the platform of the Burlington, Cedar Rapids & Northern, in front of the Hotel Orleans, was taken up and strewn over the grounds of the state fish hatchery; one chimney on the hotel was blown down and it crashed clear through the roof, but otherwise the hotel did not seem to be injured. Two freight cars in Spirit Lake were blown over and two at Montgomery, one of them being utilized for a temporary home by John Montgomery. He was in the car at the time and was badly shaken up, but luckily escaped without serious injury or broken bones.

The only fatalities heard of occurred near Petersburg, a few miles north of Superior. Mr. and Mrs. Eglenstein were living in a barn not far from the state line. The barn was blown to pieces and both occupants killed.

The wind and rain was followed by an electrical storm of great severity and also magnificence. In Estherville, Painter Greenfield was struck by lightning and his shoes completely torn off, and his stockings perforated with holes as if made with shot. He was badly shocked, but is recovering. Marcus Coon, who was near Mr. Greenfield at the time, was smoking a briar pipe that had a metal band about the stem. The lightning tore this off and pulled the bowl and stem of the pipe from the mouthpiece, leaving Mr. Coon with only the latter sticking from his mouth.

At the residence of F. C. Williams the electrical fluid cut up some queer antics. It seemed to come in under the door in a blaze and crackled in an alarming manner. Clarence Williams was severely shocked.

Newspaper clippings have been received showing that the storm of the evening of the 19th reached localities in Boone and Story counties, causing considerable damage and bringing a heavy fall of rain. Charles Bassett, a farmer residing near Boone, was killed by lightning, and the same bolt killed a valuable team belonging to Bassett. And northeast of Ames lightning destroyed a barn containing 150 tons of hay, belonging to Orrin Shaw. Near Reinbeck, Grundy county, a barn was burned by lightning, causing loss of hay and seventeen cows and calves. The details of losses would fill many columns.

The following interesting item is clipped from the *Mt. Ayr News* of August 26th: "The barn of James Moore, south of Kellerton, was struck by lightning Tuesday, August 23d. The electricity seemed to penetrate

every part of the building, which was immediately wrapped in flames. Nine men and eleven horses were in the barn, but all got out safely. Besides the barn, twenty tons of hay, 350 bushels of corn, and farm implements were destroyed."

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THE AUGUST CLOUD-BURST IN DES MOINES COUNTY—BY MAURICE RICKER.\*

It is my purpose to give merely a statement of facts concerning the storm which deluged Des Moines county the morning of August 16, 1898. I believe it was the heaviest rainfall ever noted in the United States for the period of its duration, and while the area covered was not large, it proved to be very destructive. No doubt there have been storms in which the precipitation was as heavy where no one saw fit to chronicle the event. Many great disasters, as the Johnstown flood, with a greater area and less precipitation, have become historic, because of loss of life.

My attention was called to the excessive rainfall that morning at daylight by the little swollen creek which divides South from West Hills in the city of Burlington. Yet this was in the very edge of the storm. The newspapers contained many sensational stories of narrow escape from loss of life, damage to county, city, railroad and farming interests. I read these with no special interest and dismissed their estimates of 16 to 20 inches of rain in Flint valley as exaggerations so commonly found in popular accounts of natural phenomena. As soon as the tracks were repaired I had occasion to make many trips by rail through the flooded district. The terrible strength of the water flow then became apparent and, noting the limited drainage area of Dry Branch in particular, I began to take more interest in the event, believing at this time that the real precipitation must be about five or six inches. I have since made a thorough canvass of the county and record for those interested in these phenomena only those things which are beyond dispute.

At 10 o'clock on Monday night, August 15th, it began to rain. The precipitation was not extraordinarily heavy, and, while it rained steadily, no one noticed that there was anything unusual about it. According to good authority the so-called cloud-burst began about 2 o'clock A. M. and ceased shortly after 4. It rained, more or less, for an hour later, however. A liberal estimate of time for the heavy rain is three hours. The precipitation outside of these hours, from all accounts, could hardly have been more than two inches.

The area of heavy rainfall can be approximately bounded on the south by the divide between Spring creek and Flint river. The former stream was not out of its banks. Keokuk reports a trace only. The county line forms a close boundary on the west, Yarmouth being in the edge of the heavy rain, but suffered only from lightning. Washington reports 1.72; Iowa City, .40. The north boundary of very heavy rain is not far above the county line, Wapello reporting 5.16. On the east, the river was the boundary for excessive rain, although the precipitation was heavy as far east as Biggsville, Ill. This maps out two-thirds of Des Moines county, or approximately 250 square miles. The Flint river and its tributaries drain one-half of this area. Dry Branch, Yellow Springs, Dolbee and Swank creeks

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\*Paper read before the Iowa Academy of Sciences, December 23, 1898.



drain the remainder, save a strip of three miles in width, which drains north into Louisa county. Dry Branch drains only about eleven square miles, yet its waters caused much damage. Yellow Springs creek drains a much larger area and carried perhaps more water proportionately to its bed than Dry Branch.

It is not easy to estimate the rainfall accurately. There was no rain gauge in the county at this time. I shall give some of the reports as I obtained them. Great care has been taken to get accurate and truthful accounts of this phase of the investigation.

Mr. J. W. Merrill, editor of the *Mediapolis New Era*, vouches for this story: A large circular windmill tank, with nearly straight sides, stood removed from buildings upon level ground. It had never been used as a tank and was dry Monday night. It had a semi-circular cover which was open, exposing one-half the tank to the rain. The water in the tank measured twelve inches in depth on Tuesday morning. We will grant that some of the water in the tank ran in from the half which was covered. Yet, had it all run in—and it could not—there would have been a rainfall of twelve inches. If the tank had been perfectly level would more than one-half the water which fell on the cover have entered the tank?

In Dry Branch valley below Latty, six miles south, lives a member of the county drainage board, a man whose judgment can be relied upon. He states that on Monday night an empty, straight-sided tin can, which was used for mixing spray fluids for fruit trees, was left in open ground. The can was about fifteen inches in diameter and sixteen inches high. At 5 o'clock the can was full and running over. North of West Burlington lives a truck gardener, who left standing in the garden several sprinkling pots, whose open tops are half covered with tin in the usual manner. These ought to have shed one-half the water, yet daylight found them all with eight or nine inches of rainwater in them.

Other less reliable cases have come to my notice, where the hole of a barrel becomes the outlet for overflow, etc. The instances given suffice to show the character of the information which leads me to firmly believe that over an area of fifty square miles at least sixteen inches of water fell in three hours.

The instances of incredibly rapid rise in streams, even when already in the flood plains, seem to corroborate the estimates given above, while the records at the Mississippi bridge at 6 P. M., August 16th, show a state of 4 feet 5 inches, a rise of 3 feet 2 inches. When we remember that local rain seldom affects the stage of water noticeably, and take into account the limited area of the storm, we must readily see that something extraordinary must have happened. The rain extended some distance up the river, it is true, Clinton reporting 3.01, Davenport 2.24.

The erosion was well in keeping with the figures given for rainfall. Little idea can be conveyed of the force of the water, which tore up trees twelve inches in diameter and floated rocks weighing hundreds of pounds many feet from their former location. Hay stacks were floated bodily against steel bridges, carrying them many hundred yards down stream. In the city of Burlington whole timber piles floated from the yards and blocked the entrance to the great sewer. Wagons and farm machinery of all kinds went down the Mississippi river, together with many dead animals. The oldest settler had never seen the water so high in these valleys.

Many houses, barns, sheds, etc., were flooded, and this in spite of the rapid fall of these streams, which here break through the escarpment to the Mississippi.

The upper valleys broaden out with many fertile plats, often planted in truck and garden produce. The lower stream has low banks through the flood plain of the Mississippi. The rush of water necessarily did very great damage to both crops and soil. In many cases acres of ground which had been fall plowed were denuded of soil and left covered with sand and pebbles.

Flint river, which formerly entered into O'Connell slough after paralleling its course for half a mile, cut a new channel directly through cornfields to the slough, tearing out acres of soil with crops and timber. A raft of logs belonging to the J. D. Harmer Manufacturing company went down before it like straws. O'Connell slough, which had been the storage place for logs in summer and steamboats in winter, was piled with the debris, which will cost \$15,000 to remove unless the ice and high water next spring can scour it out. Manufacturing establishments situated upon the slough will otherwise be cut off from navigation.

Hawkeye creek, a covered sewer through Burlington, became clogged with floating lumber and caused much damage to lumber yards, a foundry, the pickling works and the Murray Iron works. The stone apron at its mouth went out. The clearing of the sewer and the rebuilding of the apron will cause the city's heaviest bill for damage. The county lost twenty-three bridges, some of which have been replaced at an immediate outlay of \$16,000. The Burlington, Cedar Rapids & Northern railway lost nearly two miles of track and five bridges. The bridges which replaced the lost ones are fine steel spans, much better than the old ones, costing \$30,000. The loss to land owners is hard to estimate, but must have been very heavy in crops and damage to soil. The loss of live stock drowned would probably have been almost as heavy had it occurred in daylight, owing to the very rapid rise of the streams. The estimate of \$100,000 total loss is not far from correct.

There are many other interesting features which should be written up. The weather conditions can be obtained from the Weather Bureau. The map for the date shows a low reaching into Iowa, but would not warrant a forecast of general rain. The energy liberated by so heavy a fall of rain would form an interesting study. I have collected some data concerning similar storms in previous years. The heaviest fall that has come to my notice was fifteen inches, at Wilmington, Del., on the 29th of July, 1839.

#### SEPTEMBER.

The mean barometric pressure for the month was 29.98 inches. The highest observed was 30.60 inches, at Cresco, on the 10th; lowest, 29.62 inches, at Des Moines, on the 4th and 29th.

The mean temperature of September for the state at large was 65.3°, which is slightly above the normal for the month. The mean of the northern section was 63.4; central section, 65°; southern section, 67.6°. Clarinda reported the highest monthly mean, 72.6. The highest temperature reported was 99°, at Galva, on the 1st, and the lowest was 29°, at Britt, Estherville, Sibley and Spencer, on the 30th.

The average precipitation for the state was 2.69 inches, slightly below the September normal. By sections the averages were as follows: Northern section, 1.38 inches; central section, 2.67 inches; southern section, 4.02 inches. The maximum amount reported was 8.45 inches, at Fort Madison; least amount, .41 of an inch, at Estherville.

There were 16 clear days, 5 cloudy and 9 partly cloudy.

#### OBSERVERS' NOTES.

*Atlantic*—J. W. LOVE. Thin ice formed on the morning of the 30th.

*Alta*—DAVID E. HADDEN. On the 2d a low, flat, but bright aurora was observed. A very dry month.

*Bonaparte*—HON. B. R. VALE. Another wet month; 7.30 inches rainfall following August with 10.55, and 35.12 the last five months, and 48.24 since January 1st, is evidence sufficient that the soil is full of water. Fall seeding not nearly done.

*Centerville*—GEORGE GOODLANDER. Very warm and dry during the entire month.

*Clinton*—LUKE ROBERTS. A fine month for the maturing of crops. Latter part of the month warm.

*Estherville*—M. L. ARCHER. Killing frost on the 30th; thin ice formed on standing water.

*Forest City*—J. A. PETERS. Corn all out of the way of frost. A splendid fall for all kinds of work. Pastures afford plenty of feed for cattle. Great deal of fall plowing done. Hog cholera quite bad.

*Grand Meadow*—F. L. WILLIAMS. Ice formed on low ground on morning of 12th; no damage on high ground. Extremely warm and dry.

*Larrabee*—H. B. STREVER. Another warm September. Vegetation on low ground killed by frost on 30th. Corn ripe.

*Oskaloosa*—JOSEPH BOYD. The month of September was noted for high and low temperature, which was favorable for maturing the corn.

*Ovid*—H. C. MILLER. The most tender vegetation is green yet. The corn crop in this county is the largest ever known.

*Sidney*—G. V. SWEARINGEN. A severe thunder and hailstorm the 5th, which damaged all kinds of fruit; stripped apple trees and grapevines of about all their fruit. A strip from four to six miles wide crosses the county from west to east. Hail as large as hens' eggs and smooth.

#### OCTOBER.

The mean pressure for the month was 30.2 inches. The highest observed was 30.55 at Clarinda, on the 30th; lowest, 29.39 at Davenport and Des Moines on the 17th.

The month of October was cooler than usual, with more than the normal amount of precipitation. The first half of the month was generally fair and seasonable, and the last half wet and cold, with storms of unusual severity.

The average temperature for the state was 47.5°, which is about 3° below the October normal. The average for the northern section was 45.8°; central section, 47.2°; southern section, 49.5°. The highest temperature reported was 90° at Maquoketa on the 3d; lowest temperature, 17° at Estherville on the 31st.

The average precipitation for the state was 3.56 inches, which is about 1.33 inches above the October average. By sections the averages were as

FINAL CROP REPORT, 1898--AVERAGE PER ACRE AND TOTAL YIELD BY COUNTIES.

COUNTIES.	WINTER WHEAT.		SPRING WHEAT.		CORN.		OATS.		RYE.		BARLEY.		FLAX.		POTATOES.		CULTIVATED HAY.		WILD HAY.	
	per	ushels	per	ushels	per	ushels	per	ushels	per	ushels	per	ushels	per	ushels	per	ushels	per	ushels	per	ushels
Plymouth	20	1,340	13	1,027,800	35	4,361,480	35	2,184,000	13	10,833	27	280,719	10	2,060	72	208,304	2.7	27,170	1.0	30,070
Pocahontas	..	..	16	219,853	35	2,612,540	37	1,940,891	17	16,150	31	165,391	11	80,763	52	89,492	1.7	9,775	1.4	60,170
Polk	20	16,120	16	115,008	34	3,843,696	30	1,090,020	17	24,337	..	..	..	..	47	217,893	1.8	40,230	1.5	16,395
Pottawattamie	16	20,144	15	987,795	33	6,796,053	32	1,543,748	15	28,180	24	70,273	..	..	68	284,320	2.0	25,039	1.0	21,300
Poweshiek	19	11,647	16	16,448	34	3,203,518	32	1,551,003	15	34,295	27	27,702	..	..	110	133,870	2.0	77,080	1.5	2,550
Ringgold	20	47,080	12	2,220	31	2,911,551	25	671,200	19	29,163	20	5,940	..	..	68	45,110	1.8	70,182	1.0	1,850
Hac	..	..	16	277,200	33	4,398,780	40	2,299,690	16	23,895	30	210,540	10	37,410	90	137,070	1.6	31,185	1.0	21,220
Scott	15	195,720	18	56,267	30	1,782,150	26	796,250	13	29,528	24	481,608	..	..	90	670,960	1.7	46,631	1.5	8,085
Shelby	19	7,650	16	649,888	35	3,877,160	37	1,297,637	12	18,730	25	277,925	..	..	75	181,425	2.0	41,530	1.0	9,490
Sioux	..	..	15	2,253,715	39	4,460,391	32	2,176,672	18	10,800	27	884,115	11	17,710	87	143,115	1.8	4,904	1.0	34,140
Story	24	2,928	17	66,640	36	4,004,668	34	1,981,146	19	46,759	25	20,150	10	3,500	59	69,089	1.8	35,208	1.0	26,250
Tama	19	9,842	15	86,670	35	3,425,450	28	1,692,424	15	41,335	27	599,724	..	..	95	165,110	1.9	61,294	1.0	11,240
Taylor	21	144,123	15	10,335	30	2,869,600	27	673,839	15	7,410	22	6,006	..	..	40	133,880	2.0	72,840	1.0	2,180
Union	19	10,412	22	8,294	28	2,011,912	23	637,940	12	9,384	..	..	..	..	52	51,948	1.7	45,849	1.0	1,018
Van Buren	12	96,120	13	1,740	30	1,247,250	18	253,336	9	11,736	..	..	..	..	64	27,530	1.8	33,598	..	..
Wapello	20	148,840	15	1,050	32	1,970,240	33	513,810	17	38,063	..	..	..	..	70	90,300	2.0	32,900	..	..
Warren	17	15,538	18	72,163	30	2,577,870	30	830,460	17	47,974	..	..	..	..	62	131,812	1.7	51,527	1.0	2,105
Washington	17	60,269	14	1,330	33	2,981,890	31	1,112,714	15	39,960	..	..	..	..	74	59,644	1.7	69,938	1.0	670
Wayne	12	15,488	..	..	36	2,654,496	24	612,064	12	23,008	..	..	..	..	78	184,160	2.0	94,840	1.0	680
Webster	..	..	17	110,789	35	3,921,400	40	2,388,920	20	24,830	30	96,300	10	22,250	43	74,390	1.8	16,542	1.0	48,420
Winnebago	..	..	16	376,928	37	1,340,843	35	1,132,255	16	1,856	40	224,560	13	132,275	107	67,196	1.5	6,165	1.0	38,610
Winneshek	19	9,063	18	108,000	38	2,629,936	36	2,339,660	18	32,076	25	400,568	12	135,048	75	99,525	1.6	53,548	1.0	9,330
Woodbury	18	2,700	17	901,408	37	5,973,983	31	1,139,144	20	44,720	28	102,102	8	1,280	52	121,576	1.6	14,923	1.0	30,130
Worth	..	..	15	101,880	36	1,385,852	36	1,859,400	16	12,128	28	303,460	10	102,580	103	86,726	1.8	19,998	1.0	21,115
Wright	..	..	18	130,806	35	2,000,555	35	2,129,085	19	6,042	31	139,952	9	71,460	69	66,340	1.8	23,066	1.0	35,501
Total yield	..	3,168,916	14 8	19,153,352	31 5	289,214,850	32 5	139,915,340	..	3,370,550	..	14,138,011	..	3,376,604	..	12,538,411	..	3,852,561	..	1,645,419
Average per acre	16.6	..	..	..	..	..	..	..	16	..	27 5	..	10.5	..	76	..	1 7	..	1.2	..

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follows: Northern section, 3.61 inches; central section, 3.76 inches; southern section, 3.42 inches. The maximum amount for the month was 5.75 inches at Ridgeway; least amount reported, 1.27 inches at Larchwood. The greatest daily precipitation was 3.42 inches at Hawkeye on the 21st. Snow fell at various localities on the 17th, 18th and 25th. There were 7 clear days, 9 partly cloudy, and 15 cloudy. The average percentage of sunshine was unusually low.

## OBSERVERS' NOTES.

*Afton*—HON. N. W. ROWELL. First frost on the 6th; second frost on 14th and froze ice. On 26th ice formed half an inch thick.

*Amana*—CONRAD SCHADT. First killing frost on the 14th, but many tender plants escaped total destruction. The snowstorm on the 25th was quite unusual for this month. It was like a regular blizzard, only not so cold. When it ceased the snow measured 4 inches, and traces of the snow were still visible on the 30th.

*Atlantic*—J. W. LOVE. Severe snowstorm on the 17th, melting in large part as it fell.

*Alta*—DAVID E. HADDEN. First snow of the season fell on the 17th—an old-fashioned blizzard, with high northwest wind, continuing until early morning of the 18th. About six inches of heavy snow remained on the ground after the storm, and it would have made fully nine inches in all if it had been colder. It was the severest storm at this time of year for eighteen years.

*Bonaparte*—HON. B. R. VALE. A cold, wet month, not favorable for fall grain or the maturing of corn; soil full of water.

*Bedford*—PROF. E. H. GRIFFIN. Snow fell from before daylight till night on the 17th, the greatest depth observed being 4 inches. There had been no killing frost and vegetation was nearly as green as in midsummer. Rain and snow on the 25th; first freeze on 26th. Petunias and many other flowers were not frozen until the 26th.

*Cresco*—GREGORY MARSHALL. The first real killing frost was on the 22d, and up to that date tomato plants were growing green in the yards.

*Clinton*—DR. LUKE ROBERTS. The storm of the 25th was rain, snow and wind; the snow clinging tenaciously to trees and shrubs. Most of the trees had parted with few of their leaves and consequently held more snow than the limbs had strength to support, and great damage resulted. Corn was also damaged badly.

*Dows*—R. E. FULLER. First frost of the fall occurred on the 6th; and on the 14th there was a killing frost, exceeding severe.

*Denison*—JAMES H. HOLMES. First killing frost on the 6th; snowed all day on the 17th.

*Eldon*—T. MADDEN. On the 14th the first killing frost was noted; on the 25th, rain, snow and sleet.

*Forest City*—J. A. PETERS. October has been a very wet month, pastures are good, and conditions were favorable for farm work, except threshing.

*Fort Madison*—MISS L. A. MCCREADY. The storm of the 25th—rain, snow and wind—caused considerable damage to trees.

*Greenfield*—J. G. CULVER. On the 7th tree toads were heard; first snow fell on the 17th, with heavy north wind; on the 20th first ice observed.

*Grundy Center*—GEORGE F. ELLIS. October 18th the first snow of the season began falling at 5 A. M., and changed to rain; many potatoes still unharvested.

*Grand Meadow* (Clayton Co.)—F. L. WILLIAMS. On the 17th and 18th, 2.60 inches of rain fell, and mostly went into the soil. On the 25th a heavy, wet snow fell nearly all day; surface of ground is very wet.

*Humboldt*—H. S. WELLS. Snow on the 17th; probably about 4 inches. The month has been good for pastures and for seed to germinate; corn is being cribbed in good condition.

*Iowa Falls*—J. B. PARMELEE. A continuous rain fell from early morning of the 16th to 3 P. M. on the 17th; on 18th, rain and snow flurry.

*Keosauqua*—JOHN H. LANDES. Snow fell nearly all day on the 25th, but most of it melted as it came and only 2 inches remained when the storm ceased.

*Logan*—MRS. M. B. STERN. The 17th brought an unusual snowstorm for the season; the next morning I found 10 inches of wet snow on the ground, and 1.63 inches of water in the gauge.

*Monticello*—C. E. HEISEY. A heavy snowstorm visited these parts on 25th, falling from 9 P. M. on the 24th till 6 P. M. on the 25th, making .90 of an inch when melted; said to be the hardest storm on record for October.

*Marshalltown*—C. M. COOK. Light frost on the 6th; heavy frosts on 14th, 23d and 31st.

*Newton*—A. LUFKIN. Last half of the month was very unfavorable for farming operations.

*Ovid*—H. C. MILLER. Snow fell on the 18th, but melted as it came. Snow on the 25th was very damp, leaving 6 inches on the ground at close of storm. It was the worst storm in October for 35 years.

*Olin*—REV. NATHAN POTTER. A remarkable snowstorm occurred on the 25th, melting about half as fast as it came, leaving 6 inches at its ending. Leaves were green, and it was a remarkable sight for this latitude.

*Pella*—T. W. COX. First heavy frost on 14th, killing all vegetables. On the 18th light snow, melting as it fell. On the 25th, snow fell from 6 A. M. till 12 M., and melted rapidly.

*St. Charles*—R. D. MINARD. Tender plants killed; petunias, chrysanthemums, pinks, verbenas, pansies and other hardy plants were still growing at close of the month.

*Sidney*—G. V. SWEARINGEN. On the 17th a very wet snow fell, making 2.75 inches of water when melted, the heaviest that has fallen here in the forty-one years I have lived in this place. On the 25th 1 inch of snow fell.

*Tara*—W. E. HUMPHREY. Heavy white frost on the 14th. On the 17th 1 inch of snow fell, with cold northwest wind.

*Villisca*—C. E. MATTESON. Storm of 16th and 17th was severe on stock, because unseasonable. Light snow flurries on the 25th. From the 16th to 21st the sun was visible only 15 minutes.

*Wapello*—G. W. SCHOFIELD. An unprecedented snowstorm, almost a blizzard, occurred on the 25th; 3 inches of snow was on the ground when it ceased. Bad weather for drying corn.

*Whitten*—FRANK P. BUTLER. First snow on 18th; cold, wet month. Corn husking about two weeks behind usual time; yield of corn good.



*West Branch*—A. A. MADSON. Light snow with rain on 18th; snowed from 5 A. M. till 5 P. M. on the 25th, with strong northwest wind.

## NOVEMBER.

The mean pressure for November was 30.06 inches; the range for the state was 1.23 inches.

The first and second decades of the month were generally mild, but the last decade brought severe storms of rain, snow and sleet, and weather of the wintry type. The advent of winter was nearly a week earlier than usual in this section.

The mean temperature for the state was 32.2°, as shown by records at 112 stations. By sections the averages were as follows: Northern section, 29.8°; central section, 32.2°; southern section, 34.5°. The state average, 32.2°, is slightly below the normal for November.

The precipitation by sections was as follows: Northern section, 1.56 inches; central section, 1.40 inches; southern section, 1.41 inches; average for the state, 1.50 inches. The precipitation was largely in the form of snow and sleet, and was fairly well distributed. The "norther" on the 21st and 22d was unusually severe for the month of November. At Sioux City on the 22d the wind attained the extreme velocity of 60 miles per hour.

## OBSERVERS' NOTES.

*Alta*—DAVID E. HADDEN. A "norther" raged all day of 21st, the high northwest gales continuing until evening of the 22d. Snow drifted greatly and in places was five or six feet deep. It was one of the severest blizzards in this section for many years. A cold wave followed which continued nearly all week.

*Bonaparte*—B. R. VALE. A variable month. Many snows of small importance. A poor month for gathering corn.

*Denison*—J. H. HOLMES. Very severe storm all day of 21st. Snowed and blowed until all business and work was stopped.

*Grundy Center*—GEORGE F. ELLIS. Only half of the corn crop has been gathered.

*Humboldt*—H. S. WELLS. The snow caught the farmers with much corn in the field. Where it stands up it is being gathered. Ground was not frozen when snow came.

*Iowa Falls*—J. B. PARMELEE. A cold rain, freezing as it fell, began at 5 A. M. of the 21st, and continued to about 10 A. M., when it gradually changed to sleet and snow, wind changing to northwest. By night a genuine blizzard was in progress, continuing all night and till noon of the 22d.

*Larrabee*—H. B. STREVER. A blizzard raged on the 21st, from early morn till late at night. Stock suffered generally.

*Linn Grove*—J. W. HUBBARD. Sun dogs on the 22d and 23d.

*Monticello*—C. E. HEISEY. This has been a severe month for the farmers. The different snowstorms of November 20th, 27th and 28th have caught a great many of our farmer friends with all the way from ten to fifty acres of corn to pick.

*Sidney*—G. V. SWEARINGEN. Severe blizzard the 21st. Drop in temperature of 64° in twenty-eight hours; 14 2 inches of very light snow fell.

*Toledo*—CHARLES MASON. The fore part of the month was rather mild and favorable for corn husking. The latter part was stormy with considerable snow and good sleighing.



*Thurman*—C. R. PAUL. One of the worst blizzards that ever visited this section of the country at this time of the year was on the 21st. Four inches of snow and a very strong wind that drifted snow badly.

*Washta*—H. L. FELTER. Big blizzard on the 21st. Coldest weather 13° below zero on the 25th.

*Whitten*—F. P. BUTLER. Rain, sleet and snow on the 21st; temperature fell 59° in thirty-six hours.

*Wapello*—G. W. SCHOFIELD. Thunder on the 21st; it has been a very disagreeable month for farmers in keeping them out of the cornfields.

*Ridgeway*—ARTHUR BETTS. A good month, though the last nine days were decidedly wintry. A good month for fall work. Ground froze up on the 22d. The night of the 4th was phenomenally warm, mercury not going lower than 50°. We had seven hazy days which farmers call Indian summer. There was constant lightning in the east on the 4th in the evening, after the warm night and two warm days.

#### DECEMBER.

The mean pressure for the month was 30.18 inches. Clarinda reported the highest, 31.07 inches on the 9th; lowest, 29.43 inches, at Dubuque, on the 29th.

The month was colder than usual in all parts of the state. The monthly mean as deduced from reports of 111 stations was 18.1°. The highest monthly mean was 27.1° at Ft. Madison, and the lowest, 9.7° at Estherville. The mean temperature by sections was as follows: Northern section, 15.1°; central section, 18.3°; southern section, 20.8°. The highest temperature reported was 60° at Wapello on the 29th; lowest, 25° below zero at Estherville, Mason City and Ruthven, on the 31st. There were several cold waves during the month; the most severe cold waves occurred on the 13th and 30th.

The precipitation was generally very light, the average for the state being .48 of an inch. The average for the northern section was .28 of an inch; central section, .42; southern section, .73. The range was a trace at Mason City, and 1.70 inches at Eldora. There were 15 clear days, 8 partly cloudy and 8 cloudy. The highest wind velocity was 44 miles an hour at Sioux City, on the 24th.

#### OBSERVERS' NOTES.

*Alta*—DAVID E. HADDEN. Norther in afternoon of 29th, followed by severe cold wave on 30th. Temperature fell 44° in eighteen hours.

*Amana*—C. SCHADT. A large part of the corn crop was in the field yet at the beginning of the month, on account of the unseasonable weather in the fall. This month, however, although generally cold, was most favorable for gathering the crop in.

*Bonaparte*—B. R. VALE. A pleasant winter month, good for all kinds of winter work and stock feeding. No snow in this locality.

*Clinton*—DR. LUKE ROBERTS. December, 1898, was cold, quite clear and nearly stormless, with less than normal force of wind. Mean temperature, 21.1°; normal being 24.9°. Maximum temperature, 53°; normal, 53.6°. Minimum temperature, 8° below zero; normal, 9.4° below zero. Mean temperature of the warmest day, which was the 29th, was 35.3°; normal being 44.1°, or 8.8° warmer than the warmest December day for 1898. The coldest

day, the 31st, gave a mean temperature of 1° below zero, while a December normal for the coldest day is 9 9° below zero. The movement of the wind was 3,780 miles, or 660 miles below normal. The maximum was 23 miles an hour, occurring on the 6th. The prevailing direction was from the west. There were five days with storm, the total precipitation amounting to only .45 of an inch of water. The total snowfall did not reach 2 inches.

*Grand Meadow*—F. L. WILLIAMS. The month was cold, culminating in a fall of 46° in sixteen hours on the afternoon of the 29th; mercury rose 1.15 inches in the same time. Good sleighing most of the month. Cholera still killing hogs in some localities; other stock doing well.

*Ovid*—H. C. MILLER. At noon on the 29th thermometer stood at 49°; the next morning, at 7 o'clock, it was zero.

*Villisca*—C. E. MATTESON. Total eclipse of moon on 26th; total from 6:15 to 7 P. M.

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## WEATHER AT CLINTON, 1898.

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### ANNUAL REVIEW BY DR. LUKE ROBERTS.

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The year 1898 was an off year, meteorologically as well as politically. None of the conditions were normal, yet plentiful harvests and general prosperity prevailed. Few alarmists of any grade or color were to be seen or heard.

It is interesting to note many of the meteorological peculiarities of the year. The number of storm days was 116, and, during the last twenty years, was exceeded only in 1884, which furnished 125 stormy days. The number of cloudy days was 129 and the number of clear days 141. The former, during the last 20 years, was exceeded only in 1884, by five days, and the latter in 1897 by two days, in 1896 by one day, in 1895 by six days.

The rainfall exceeded any former year's precipitation during the last twenty years by 3.44 inches; exceeding normal by 11.35 inches. The fall of snow exceeded normal by 7.35 inches.

The movement of the wind was less than normal by 9,850 miles. The first six months furnished an excess of precipitation. So, also, did October. From the fact that the last five previous years were deficient in rainfall, the excess referred to proved a great blessing to farming interests as well as replenishing springs and streams which had for a long time been low.

Notwithstanding June precipitation was great, the condition of the soil was excellent, and the outlook was promising for a generous harvest.

January and February furnished about thirty days of very good sleighing. On the 11th of January the first thunder and lightning occurred, which, coming unannounced and terrific, frightened many people by being suddenly awakened from a sound sleep, and thinking the whole city was on fire from the intensity of light.

Nearly every month furnished an electrical storm of more or less intensity. Especially severe and damaging was the one occurring on the 16th of August.

A very destructive tornado passed over the northern portion of Clinton county on the afternoon of May 18th, in which several lives were lost, and many thousands of dollars' worth of property destroyed.

Notwithstanding the large per cent of cloudiness, the temperature and moisture combined to bring growing crops to a normal condition by the last of May. The drouth of July following the excessive rains rendered the quality and flavor of fruits and vegetables inferior.

The hay crop, however, was large, of good quality and saved in good condition. During July and August farmers felt some uneasiness as to the outcome of corn, much of it being late planted and but little of the land could be properly worked at a seasonable time on account of being too wet, so that the weeds got some advantage.

And by the time the fields were in good condition for the cultivator much of the corn had got so large that the stalks were easily broken by cultivating. Besides these reasons the season was so far advanced as to leave a too short time for corn to mature before frost might be expected. The season, however, proved long enough, as the first frost to injure vegetation came later than was ever known, to the delight of everybody.

The first freezing temperature occurred on the 12th of October—an exceptionally disagreeable month, with only four clear days. The foliage remained green and beautiful until after the heavy snow and windstorm of the 25th, which made havoc among trees and shrubbery, breaking and splitting large numbers. About a week elapsed ere all the snow had disappeared, and with it the foliage. It was a sudden transformation of a bright summer into a barren winter, although pastures and lawns remained green until November.

Corn, which had been badly bent in all directions by the heavy rains and winds previously, was rendered difficult to harvest, but yet was in good condition for cribbing.

The weight of snow pressed it closer to the ground, and not only increased the difficulty of gathering, but did much damage to the crop. However, the weather was favorable to the germination of wheat and rye, an increased acreage of which had been sown.

The eleventh month was 1.5 degrees colder than a November normal—there having been but two colder in two decades. December was cold, clear and almost stormless, which furnished the best of conditions for the formation of ice. The ice harvesters were pleased, and lost no time in filling their immense ice houses with a superior quality of ice, besides doing a large shipping business.

#### CONSPECTUS.

Highest temperature, 99°, July 19th.

Lowest temperature, 8° below zero, February 3d and December 31st.

Extreme range of temperature, 35°.

Mean daily temperature, 48.5°, or 1.5° above normal.

Mean daily range of temperature, 21°.

Greatest mean monthly range of temperature, 27°, occurring in July.

Least mean monthly range of temperature, 16.3°, occurring in October.

Greatest daily range of temperature, 39°, occurring on the 3d day of June; maximum being 91°; minimum 52°.

Least daily range of temperature, 3°, occurring on the 21st of December.

Warmest month, July, mean temperature, 71.8°.

Coldest month, December, mean temperature 21.1°.

Warmest day, June 24th, mean temperature, 84°.

Coldest day, February 2d, mean temperature, 2.5° below zero.

Total number of days with maximum temperature, 90° or above, 28; 6 in June, 14 in July, 5 in August, 3 in September.

Total number of days with the maximum temperature at 32° or below, 39; 8 in January, 10 in February, 1 in March, 6 in November, 14 in December.

Total number of days with the minimum temperature at or below 32°, 148; 30 in January, 25 in February, 22 in March, 8 in April, 8 in October, 24 in November, 31 in December.

Mean daily cloudiness, 48 per cent of the surface of the sky.

Month with the greatest per cent of cloudiness, October, 67 per cent.

Month with the least per cent of cloudiness, July, 24 per cent.

Total number of clear days, 141.

Total number of cloudy days, 129

Month with the greatest number of clear days, July, 21.

Month with the least number of clear days, October, 4.

Month with the greatest number of cloudy days, October, 19.

Month with the least number of cloudy days, July, 3.

#### PRECIPITATION.

Total depth of snowfall, 54 inches.

Greatest fall of snow at any one storm, 13 inches, February 20th.

Total precipitation rain (and snow melted), 46.48 inches.

Greatest rainfall in 24 hours, 4.61 inches, June 13th. August 16th furnished next, 3.01 inches.

Month with the greatest precipitation, June, 8.02 inches.

Month with the least precipitation, December, .42 inches.

Month with the greatest number of storm days, October, 15.

Month with the least number of storm days, December, 5.

Total number of storm days, 116.

#### THE WIND

Total movement of wind, 32,776 miles.

Maximum velocity per hour, 27 miles, occurring in October and November.

Greatest monthly movement, 3,896 miles, in February; least monthly movement, 1,280 miles, occurring in August.

Prevailing direction of the wind was from the observations taken at 7 A. M., 2 P. M., and 9 P. M., show the movement of the wind to have been from the north 87 times, from the northeast 131 times, from the east 98 times, from the southeast 80 times, from the south 172 times, from the southwest 155 times, from the west 193 times, from the northwest 169 times.

Maximum velocity of the wind for January 28 miles an hour, for February 21 miles, for March 23 miles, for April 22 miles, for May 20 miles, for June 13 miles, for July 18 miles, for August 24 miles, for September 23 miles, for October 27 miles, for November 27 miles, for December 23 miles.

#### SNOW AND FROST.

The last spring snow fell on the 22d day of March.

The first snow to cover the ground made its appearance on the 25th day of October.

Last frost in spring severe enough to injure vegetation, April 21st.  
Last light frost May 12th.

First hoar frost in autumn, October 12th.

First killing frost in autumn, October 14th.

Number of consecutive days without frost, 152.

The temperature of the air was at freezing point or below for the last time in the spring, on the 21st day of April.

The first in autumn, October 14th.

The last day in the spring when the mean temperature was below 32°, April 5th.

The first in autumn, October 25th.

#### ELECTRO METEORS.

Number of auroras observed, 1, March 15th.

Number of days with thunder and lightning, 29; 1 in January, 6 in March, 1 in April, 2 in May, 7 in June, 4 in July, 2 in August, 4 in September, 1 in October, 1 in November.

#### OPTICAL METEORS.

Number of solar haloes observed, 6.

Number of lunar haloes observed, 15.

Meteor, very fine, November 15th and April 20th. A fine rainbow on June 6th at 5:30 P. M.

The following interesting facts are gleaned:

The extreme range of the yearly mean temperature of the 20 years was 6°, the highest being 49.8° in 1894, and the least 43.8° in 1885. The normal yearly temperature for the 20 years is 47°.

The total rainfall for the same time was 702.75 inches, or 58.56 feet, averaging 35.14 inches per year, or a little over .09 of an inch per day. Total movement of wind during the last 7 years was 847,355 miles, a distance equal to 34 times the circumference of the earth.

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### WEATHER AT DES MOINES, 1898.

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#### COMPARISON WITH PRECEDING YEAR.

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The mean temperature in 1898 was 49.5°, which is .5° above the normal of the station for twenty-one years, against 49.6° in 1897, when it was .6° above the normal. The highest temperature was 99°, on August 30th, against 98° on September 1, 1897. The lowest temperature was 10° below zero, on December 31st, against 17° below zero on January 25, 1897. The mean relative humidity was 72 per cent, against 69 per cent during the preceding year.

The total precipitation in inches during 1898 was 28.33, which is 4.20 inches below the normal of the station for twenty-one years. The greatest precipitation in any twenty-four hours was 2.19 inches, against 2.95 inches in 1897. The total depth of snowfall was 37 inches, against 49 inches in 1897.

The percentage of sunshine was 60, against 59 in 1897. The average hourly wind velocity was 7.6 miles per hour, against 8.1 of 1897. The prevailing wind direction in 1898 was north, and of the preceding year southwest. The highest velocity was 40 miles an hour from the west, against 50 miles an hour from the northwest in 1897. There were 182 clear days, 95 partly cloudy and 88 cloudy days during the year, against 183 clear days, 82 partly cloudy and 100 cloudy days in 1897.

There were 38 days on which thunder was heard, against 42 in 1897. There were no auroras during the year, against 1 in 1897.

### ERRATA FOR THE 1897 ANNUAL.

	INCHES.
Denison annual precipitation should be .....	25.50
Hampton precipitation for April should be .....	4.96
Hampton annual precipitation should be .....	27.40
Centerville precipitation for August should be .....	1.62
Larrabee annual precipitation should be .....	27.38
Maquoketa annual precipitation should be .....	20.81
Mt. Ayr annual precipitation should be .....	32.68
Mt. Ayr precipitation for November should be .....	.92
Rockwell City precipitation for December should be .....	2 20
Sac City annual precipitation should be .....	22.67
Spirit Lake precipitation for November should be .....	.20
Spirit Lake annual precipitation should be .....	20.39
Toledo annual precipitation should be .....	22.02
Toledo precipitation for June should be .....	3.11
Wilton Junction precipitation for February should be .....	1.45
Wilton Junction annual precipitation should be .....	30.78
Winterset precipitation for March should be .....	1.89
Winterset annual precipitation should be .....	36.16

### IOWA'S SOIL PRODUCTS.

#### GENERAL REVIEW OF THE CROP SEASON, 1898.

The winter months were warmer than usual, with generally light precipitation, and the advent of spring was relatively early. March was warm and favorable for early farm operations, except in the southeastern counties where the soil was saturated by excessive rains. More than the usual amount of spring grain was sown in March, and there was a marked increase in the acreage of spring wheat compared with recent years.

April was nearly normal in all weather conditions, and generally favorable for preparation of soil and seeding. The bulk of small grain was sown before the middle of the month, except in the extreme north and in some of

the southeastern counties where work was retarded by excessive moisture.

The first half of May was cooler than usual, retarding the germination of seed and the growth of corn; but the last half was sufficiently warm to bring the temperature of the month up to normal. The spring months were especially favorable for the growth of grass and small grain. The pastures afforded ample feed for stock, and the meadows gave promise of a large crop of hay. On the first of June, wheat, rye, oats and barley had made phenomenal advancement, and the chief drawback was the danger of injury resulting from an excessive growth of straw. The bulk of the corn area was planted between the 10th and 25th of May, and the soil was in excellent tilth. The seed was unusually sound, and the germination was almost perfect, resulting in an exceptionally good stand. And on the 1st of June the condition of corn was above the average for that date in recent years.

June was warmer than usual, with excessive moisture in a large part of the state, and all the conditions were favorable for a rank growth of vegetation, especially of the grasses, cereals and weeds. In portions of the southern districts, and notably the southeastern counties, the heavy rains caused considerable damage and greatly retarded field work. At the close of the month, however, the weather conditions were about normal, and corn was rated above the average, with small grain crops exceptionally good and promising.

With considerable variability in the daily temperatures, the average for July was about normal. The month was generally dry, though scattered localities received excessive amounts of rainfall. Drouthy conditions prevailed generally from the 3d to the 27th, mitigated in a few sections by showers the 6th and 19th. For a period of about twenty-four days the larger part of the state received very little moisture, and the greater portion of the precipitation of the month fell in the last four days. And the drouth was intensified by some high temperatures, ranging from 90° to 100°, with brisk to high winds during a part of the dry period.

Though the dry weather was somewhat unfavorable for corn, late potatoes and pastures, yet there were compensating advantages resulting from the almost ideal conditions for maturing and harvesting the unusually large crops of hay, wheat, oats, rye, and barley. In the larger part of the state the bulk of the hay was secured in perfect condition; and, for the most part, the weather was all that could be desired for cutting, shocking, and stacking the heavy grain crops, which, because of the great bulk of straw, needed continued dry weather to secure it in good order.

The condition of corn was unusually good the first week in July, giving promise of more than an average yield. The dry weather and occasional periods of high temperature that prevailed from the 8th to the 27th, during the critical stage in the development of the corn plant, unquestionably caused material injury in fields most exposed to the effects of the heat and arid conditions. The average temperature of August was very close to the normal, the first half being cooler than usual and the last half unreasonably warm. The rainfall was very unequally distributed, ranging from less than an inch to more than ten inches, the heavier amounts being reported from stations in the southeast district. The larger part of the state received considerably less than the normal rainfall for August. The first two weeks



brought some measure of relief from the drouthy conditions that prevailed through the larger part of July. Though the nights were too cool for the rapid development of corn, yet the reports showed fairly good progress of that crop, and at the middle of the month the general conditions gave promise that it would reach maturity in advance of the usual period of killing frosts. During the last half of the month the prevalent high temperatures and dry weather hastened the ripening process of the belated portion of the corn crop and brought the larger part to a sufficient degree of maturity to be cut and shocked. In some sections the extreme heat caused some damage to late corn, but generally the crop was benefited by the conditions which carried so much of it beyond the danger line. The potato crop suffered some damage by the dry and hot weather in the latter part of August.

In considerable portions of the state there was sufficient moisture in the soil to facilitate plowing, and more than the usual area had been plowed at the close of the month, and a good beginning had been made in sowing winter wheat and rye. On the whole, August was a favorable month for farm operations and for the ripening of crops.

September brought almost ideal weather for ripening the late-growing crops, for threshing and garnering the small grains, and for fall plowing and sowing fall wheat and rye. The mean temperature was slightly above the normal for the month, and there was abundant sunshine to afford normal ripening conditions. The rainfall was generally ample for current needs to facilitate plowing and to maintain growth in the pastures, though in a portion of the state the supply of moisture was somewhat deficient. The larger part of the rainfall came during the first half of the month, and at the time when it was most needed; and the bright, clear weather of the last fifteen days brought the belated fields of corn and other crops to full maturity without a touch of frost. At the close of the month more than the usual amount of fall plowing and seeding had been accomplished.

The first half of October was favorable for outstanding crops, and corn was fully ripened and nearly dry enough to crib before killing frost. But the last half of the month was cold and wet, with severe storms of rain, wind and snow flurries, causing material injury to the unharvested corn that was more or less flattened by wind and snow. The conditions were generally favorable for early sown fall wheat and rye, which have made a good stand, with an increased acreage. On the whole the crop season of 1898 has been propitious, and this state has seldom harvested more abundant yields of the staple products of the soil.

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## JUNE CROP REPORT.

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### ACREAGE AND CONDITION OF CROPS JUNE 1, 1898.

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From reports of correspondents of this service, June 1, 1898, the following summary is made, relative to the acreage and condition of the staple crops for the current season. The acreage is obtained from careful estimates of increase or decrease, compared with the number of acres harvested



in 1897. The condition is estimated in form of percentage, compared with the average or normal of the several crops.

*Wheat.*—Of winter wheat the number of acres planted last fall and not abandoned appears to be 191,451, a decrease of 3,015 acres compared with last year.

Of spring wheat the acreage is 1,293,231, an increase of 216,394 acres compared with 1897. The total acreage of winter and spring wheat for this harvest is 1,484,682 acres, as against 1,271,303 acres last year. The condition, June 1st, of winter wheat was fully 101 per cent, and of spring wheat 104 per cent. Last year on the corresponding date winter wheat was 67 per cent and spring wheat was rated 91 per cent.

*Corn.*—The acreage of corn planted this year is reported to be 8,396,286 acres—a decrease of 213,859 acres compared with 1897, or an average decrease of a little less than 2½ per cent. The condition of the crop June 1st was rated at 101 per cent; last year at the corresponding date it was 79 per cent.

*Oats.*—the total acreage of oats for the state is 4,299,243 acres, and the condition June 1st was 105 per cent. Last year the area sown was 4,405,782 acres, and the condition June 1st, 88 per cent. This shows a net decrease of 106,539 acres.

*Rye.*—Total area sown, 210,309 acres; condition June 1st, 100 per cent. Last year the acreage was 226,198, and the condition was 90 per cent.

*Barley.*—Area seeded, 509,589; condition June 1st, 102 per cent. Last year the area was 551,867 acres; condition 86 per cent.

*Flax.*—Area seeded, 225,014 acres; condition, 100 per cent; area in 1897, 249,882 acres; condition, 89 per cent.

*Cultivated Hay.*—Total number of acres, 2,230,455. Last year the area was 2,159,334 acres; an increase for this season of 71,121 acres. The condition of new seeding of timothy is 105 per cent, and of clover, 107; millet is rated at 98 per cent. This has been a very favorable season for the grasses.

*Potatoes.*—The condition of common potatoes is 101 per cent. The area planted is 164,456 acres. Last year the area was 163,248 acres; condition June 1st, 92 per cent.

Condition of other crops are as follows: Broom corn, 91; sweet potatoes, 98; sorghum, 96; apples, 98; pears, 91; plums, 80; peaches, 96; grapes, 99; blackberries, 95; raspberries, 94; strawberries, 100; currants, 97; cherries, 97 per cent.

*Live Stock.*—Condition, cattle, 104; sheep, 101; hogs, 98; spring pig crop, 76; horses, 99; foals, 91 per cent.

Meadows are rated 105, and pastures 106 per cent.

## IOWA CROPS, 1898—NUMBER OF ACRES BY COUNTIES.

COUNTIES,	Winter wheat— acres.	Spring wheat— acres.	Corn—acres.	Oats—acres.	Rye—acres.	Barley—acres.	Tame hay— acres.	Flax—acres.	Irish potatoes— acres.
Adair.....	589	11,079	108,226	52,820	693	490	23,900	.....	2,078
Adams.....	1,980	5,933	74,310	21,823	212	214	23,070	17	680
Allamakee.....	2,295	2,100	29,974	43,890	7,635	8,591	33,150	.....	1,618
Appanoose.....	2,332	69	45,351	10,258	1,165	...	43,850	.....	517
Audubon.....	82	25,582	76,213	42,298	523	2,013	13,210	.....	1,346
Benton.....	892	738	108,610	72,361	2,695	10,085	34,250	.....	2,050
Black Hawk.....	299	90	97,520	66,623	5,177	2,010	33,570	.....	1,861
Boone.....	53	2,224	97,705	47,039	1,462	480	12,250	.....	1,150
Bremer.....	98	181	56,794	51,707	2,221	1,597	18,210	.....	1,345
Buchanan.....	.....	70	84,167	59,020	3,384	1,798	32,790	.....	1,278
Buena Vista.....	.....	18,632	104,978	61,050	951	5,998	9,210	.....	2,279
Butler.....	50	1,661	103,207	77,175	4,737	2,881	15,270	.....	1,392
Calhoun.....	32	8,044	101,557	54,575	1,104	3,095	9,330	.....	1,450
Carroll.....	45	17,910	116,772	61,931	1,804	7,282	12,470	.....	2,208
Cass.....	3,099	18,906	112,110	50,341	937	1,117	15,240	.....	5,063
Cedar.....	2,751	283	103,537	43,781	1,288	4,324	47,020	.....	1,465
Cerro Gordo.....	86	2,173	77,167	68,859	2,931	6,485	5,170	.....	1,408
Cherokee.....	.....	40,164	108,425	37,118	614	9,421	15,730	.....	1,620
Chickasaw.....	43	994	61,346	63,028	1,501	4,059	18,310	.....	1,438
Clarke.....	1,185	245	59,970	19,564	2,192	90	26,550	.....	1,039
Clay.....	.....	25,475	82,339	58,809	3,327	21,307	11,280	.....	1,361
Clayton.....	6,891	2,202	74,706	65,791	9,534	4,266	22,830	.....	2,463
Clinton.....	1,944	531	117,192	61,550	7,319	915	59,240	.....	1,958
Crawford.....	57	60,775	143,633	57,390	2,651	8,478	20,310	.....	2,015
Dallas.....	2,361	4,970	104,460	43,115	1,483	270	21,630	.....	1,175
Davis.....	4,697	99	64,669	22,167	1,701	.....	34,500	.....	540
Decatur.....	6,741	150	77,560	18,003	1,265	70	34,890	.....	1,289
Delaware.....	164	424	92,195	46,077	5,845	2,522	39,850	.....	1,494
Des Moines.....	6,246	188	54,048	35,716	1,420	.....	18,180	.....	1,456
Dickinson.....	.....	19,894	27,698	23,113	814	10	1,650	6,065	670
Dubuque.....	507	523	.....	61,767	4,684	1	40,250	.....	2,497
Emmet.....	23	24,111	.....	25,536	1,075	10	1,710	7,300	621
Fayette.....	692	1,558	.....	73,795	4,600	5	44,870	3,187	1,938
Floyd.....	125	2,637	.....	62,898	2,199	3	20,820	4,128	2,906
Franklin.....	37	4,496	1	60,422	1,070	3	16,800	7,540	1,482
Fremont.....	4,348	6,710	.....	11,430	740	.....	11,080	.....	760
Greene.....	25	2,235	1	60,270	1,370	1	14,220	1,510	1,150
Grundy.....	40	4,918	.....	68,620	1,190	8	17,560	1,090	1,940
Guthrie.....	1,090	11,780	.....	55,900	1,605	.....	21,260	290	1,310
Hamilton.....	.....	3,090	.....	47,140	465	1	15,475	3,420	1,015
Hancock.....	.....	14,275	.....	60,820	790	12	8,650	15,500	980
Hardin.....	.....	5,825	.....	62,710	710	2	8,240	2,140	1,485
Harrison.....	280	39,064	.....	23,900	2,060	.....	8,603	.....	1,256
Henry.....	4,765	220	.....	37,410	1,390	.....	21,190	.....	1,040
Howard.....	90	2,624	.....	66,570	490	2	15,540	11,410	1,160
Humboldt.....	.....	21,390	.....	35,330	510	11	16,050	2,940	1,203
Ida.....	.....	2,387	.....	36,813	920	5	13,960	138	1,265
Iowa.....	836	670	.....	50,520	5,360	1	27,690	.....	1,525
Jackson.....	1,880	937	.....	43,820	10,150	.....	25,190	.....	1,680
Jasper.....	1,270	9,190	1	43,850	1,980	.....	25,730	.....	8,678
Jefferson.....	4,803	152	.....	24,610	2,210	.....	24,104	.....	547
Johnson.....	2,290	725	.....	42,318	4,450	.....	21,020	.....	1,430
Jones.....	102	181	.....	31,644	4,238	1	25,490	.....	1,009
Keokuk.....	4,035	336	.....	48,348	3,349	.....	26,118	.....	1,156
Kossuth.....	33	58,237	1	80,965	508	14	10,785	25,170	1,560
Lee.....	18,465	45	.....	18,269	2,015	.....	21,220	.....	1,463
Linn.....	268	325	1	45,667	5,192	.....	46,780	170	2,320
Louis.....	2,628	205	.....	23,871	1,512	.....	15,450	.....	604
Lucas.....	4,183	45	.....	18,541	2,002	.....	21,430	.....	528

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### JULY CROP REPORT.

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The reports of county and township correspondents of the Iowa Weather and Crop Service made a flattering showing of the condition of the crops on July 1, 1898, as will be seen by the following summary of averages for the state: Winter wheat, 97 per cent; spring wheat, 99; corn, 102; oats, 98; rye, 97; barley, 100; millet, 98; flax, 98; broom corn, 94; potatoes, 102; sweet potatoes, 97; sorghum, 99; meadows, 103; pastures, 105; apples, 79; pears, 71; plums, 70; peaches, 88; grapes, 99.

On the 1st of July, 1897, the same correspondents reported the average condition of the staple crops at much lower figures, as follows: Winter wheat, 61 per cent; spring wheat, 88; corn, 78; oats, 83; barley, 93; rye, 87; flax, 88; millet, 100; broom corn, 82; potatoes, 92; sweet potatoes, 92; sorghum, 85; apples, 84; plums, 72; grapes, 80; timothy and clover, 89.

## A COMPARATIVE EXHIBIT.

## AVERAGE CONDITION OF IOWA CROPS ON JULY 1ST FOR FOUR SEASONS.

CROPS.	1898.	1897.	1896.	1895.
Winter wheat.....	97	61	91	83
Spring wheat .....	99	88	87	93
Corn.....	102	76	92	101
Oats .....	98	83	91	102
Rye... ..	97	87	98	82
Barley... ..	100	93	97	96
Millet.....	98	100	95	93
Flax .....	98	88	94	96
Broom corn.....	93	82	91	96
Potatoes .	102	92	100	103
Sweet potatoes.....	97	92	95	93
Sorghum.....	99	85	92	96
Apples.....	79	84	83	62
Grapes. ....	99	80	92	42

## AUGUST 1ST CROP REPORT.

Reports received from the county and township correspondents of the Iowa Weather and Crop Service, on or before August 1st, have been tabulated, and the estimates as to the condition of the unharvested crops show the following averages:

Corn, 94 per cent; millet, 90; flax, 95; broom corn, 90; potatoes, 78; apples, 63; grapes, 95; pastures, 86.

The fact should be noted that since the dates on which most of these reports were written the copious rains have broken the drouth and greatly improved the condition of the crops that were most injuriously affected by heat and aridity. It remains to be seen whether or not the corn crop has been so materially injured as to reduce the final output below the average.

## CROP REPORT SEPTEMBER 1st.

The regular crop report, September 1st, made by the county and township correspondents of the Iowa Weather and Crop Service, has been tabulated and the results are given below. The report gives estimates of the condition of the unharvested crops, and the yield per acre of the cereal crops so far as may be ascertained from threshers' returns and other sources of information.

**Corn.**—The condition of this important crop is shown to be unusually variable, or "spotted," as some reporters describe it, as a natural result of the unequal distribution of rainfall in the critical stage of its growth. The estimates of condition show a very wide range in different counties and districts, the figures ranging from 60 to 120 per cent. The average of all the estimates of condition is 86 per cent for the state at large. This is a reduction of 8 per cent as compared with the August report.

The crop reporters were asked to make a careful estimate of the probable yield of corn in their respective localities, and the result accords with

their estimate of condition. The average of the estimates by counties indicates an average yield of 34 bushels per acre for the state at large, or 5 bushels per acre above the average output in 1897. If their estimates are sustained by the final returns of the harvest, the corn crop of Iowa for 1898 will be slightly above the average of the past 15 years, which is about 33 bushels per acre. This report, however, is only a preliminary estimate by the crop reporters, nearly all of whom are practical farmers, and it may be materially reduced by husking returns.

It is interesting, however, as showing that the standard of estimate is high; and the average crop reporter understands 100 per cent to signify a crop of 40 bushels of sound corn per acre.

As showing the variable condition of corn, the fact may be noted that the reports from 17 counties indicate a yield of 25 to 30 bushels per acre; 66 counties give promise of 30 to 40 bushels; and 16 counties make a showing of 40 to 45 bushels per acre.

If the estimates of our reporters are sustained by the husking returns, the corn crop of Iowa this year will be about 280,000,000 bushels, or 40,000,000 bushels in excess of the total in 1897.

*Wheat.*—Threshing returns from the counties that produce winter wheat show an average yield of 18 bushels per acre; and the reports indicate an average of 16 bushels per acre of spring wheat. These figures, if borne out by the later returns, will give the state a total wheat harvest of 24,137,814 bushels. This amount is 9,524,760 bushels in excess of the wheat output of last year.

*Oats.*—The yield of oats appears to be 33 bushels per acre, as the state average. This indicates a total yield of 141,875,000 bushels, or 9,304,000 bushels more than in 1897.

*Barley.*—Average yield per acre, 28 bushels; total yield, 14,268,492 bushels

*Rye.*—Average yield per acre, 17 bushels; total yield, 3,575,253 bushels.

Timothy seed averages 4.2 bushels per acre. Tame hay yields 1.8 tons per acre, which will give a total of 4,014,819 tons, which amount is 652,532 tons in excess of the output last year.

Wild hay will average 1.4 tons per acre, making a total of over 2,000,000 tons.

The condition of the minor crops is rated as follows: Millet, 91 per cent; buckwheat, 86; potatoes, 75; apples, 58; pastures, 84.

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### FINAL CROP REPORT, 1898.

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#### AVERAGE YIELD PER ACRE, TOTALS FOR THE STATE, AND FARM PRICES DECEMBER 1ST.

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Final reports for the season have been received from the county and township correspondents of the Iowa Weather and Crop Service, giving the average yield of the staple soil products, and the average home prices obtainable therefor on or about December 1st. The reports have been tabulated by counties, and the following summary is made for the state.

**Wheat** — Winter wheat made a large yield considering the reported condition of the crop at the close of winter. The average yield as reported is 16.5 bushels per acre, and the total output for the state is 3,168,916 bushels. The average home price is 55 cents per bushel. Spring wheat brought a total product of 19,152,352 bushels, an average of 14.8 bushels per acre. The home price is 52 cents per bushel. The aggregate amount of both winter and spring wheat is 22,321,268 bushels, valued at \$11,702,126.

**Corn.**—There has been an unusually variable output of this great staple, the county averages as reported ranging from 25 to 42 bushels per acre. The stand was perfect everywhere, and in many counties the yield was far above all previous estimates. Fifteen counties report 25 to 30 bushels, fourteen counties 40 to 42, and seventy counties range from 31 to 39 bushels per acre. The aggregate for the state, figured from the several county totals, is shown to be 289,214,850 bushels, produced from an area of 8,396,286 acres. The average for the state is, therefore, 34.5 bushels per acre. The average home price on December 1st, was 23 cents per bushel, and the present value of the crop is, therefore, \$66,519,405. The greater part of the crop, however, is not sold on the market, but is used as raw material in the manufacture of animal and dairy products, at an average increment of 40 to 50 per cent above the current prices paid for corn.

It should be stated in this connection that a considerable percentage of the corn crop in this state, probably 20 per cent, was still unharvested on December 1st, the work having been seriously retarded by the early advent of winter. A portion of the unharvested corn will likely be materially damaged, and it may be estimated that fully 10 per cent of the crop of the state will be unmerchantable, though it may possess some feeding value. The general condition of the cribbed corn is good.

**Oats.**—The total yield of oats is 139,915,346 bushels; an average of 32.5 bushels per acre; the average home price is 21 cents per bushel, making the present market value of the crop \$29,383,222.

**Rye.**—Total product, 3,370,550 bushels; average per acre, 16 bushels; home price, 33 cents per bushel; present value, \$1,280,809.

**Barley.**—Total product, 14,138,011 bushels; on an acreage of 509,589 acres; average yield, 27.5 bushels per acre; home value, average 30 cents per bushel; value of crop, \$4,209,741.

**Flax** —Total product, 2,376,604 bushels; average per acre, 10.5 bushels; average home price 80 cents per bushel; total home value, \$1,901,283.

**Potatoes.**—Total bushels harvested, 12,538,411; average per acre, 76 bushels; home value, 31 cents per bushel; value of crop, \$3,886,907.

**Cultivated Hay.**—Total number of tons harvested, 3,452,561; average per acre, 1.7 tons; value, \$4.30 per ton; total value, \$16,566,012.

**Prairie Hay.**—Product, 1,645,419 tons; value, \$5,758,966.

**Buckwheat.**—The average yield is 13.8 bushels per acre; total product, 167,740 bushels, worth \$84,870.

**Timothy Seed** — Average yield, 3.9 bushels per acre; yield (estimated), 725,000 bushels; valued at \$768,500.

**Clover Seed.**—Yield per acre, 1.7 bushels; total product (estimated), 87,550 bushels; value, \$288,915.

**Millet Seed.**—Product, 19 bushels per acre; total yield, 161,500 bushels; worth \$61,370.

*Sweet Potatoes.*—Product (estimated), 245,000 bushels; value at home, \$218,250.

*Sorghum.*—Yield per acre, 94 gallons; estimated value, \$350,000.

*Broom Corn.*—Estimated value, \$25,000.

*Corn Fodder.*—In shock and field, worth \$8,250,000.

*Pasturage.*—Estimated worth, \$30,000,000.

*Fruits and Vegetables.*—Estimated value, \$6,200,000.

The reports show the average farm price of horses to be \$50 per head; milch cows, \$35; average price of wool, 16 cents per pound. Amount of fall plowing is estimated at 88 per cent.

The reporters were asked to estimate the percentage of loss of hogs, by cholera or other disease, for the year ending December 1st. The reports show an average loss of 17 per cent for the state at large. The county estimates indicate a wide range in the ravages of the disease, from 1 per cent in several counties to 72 per cent in the county reporting the greatest loss.

GENERAL CROP STATEMENT, 1898.

CROPS.	YIELD PER ACRE.	AGGREGATE YIELD.	HOME VALUES DEC. 1ST.
Winter wheat.....	10 5	3,168,916 bus.	\$ 1,742,908
Spring wheat....	14 8	19,152,852 bus.	9,959,223
Corn .....	34.5	289,214,850 bus.	66,519,405
Oats.....	32.5	139,915,346 bus.	39,383,222
Barley.....	27.5	14,138,011 bus.	4,209,741
Rye .....	16.0	3,370,550 bus.	1,230,909
Potatoes....	76.0	12,538,411 bus.	3,886,907
Cultivated hay .....	1.7	3,852,661 tons.	16,568,012
Prairie hay.....	1.2	1,645,419 tons.	5,758,966
Buckwheat.....	13 8	169,740 bus.	84,870
Flax.....	10.5	2,376,604 bus.	1,901,283
Timothy seed.....	3.9	725,000 bus.	768,500
Clover seed .....	1.7	87,550 bus.	288,915
Millet seed.....	19.0	161,500 bus.	61,370
Sweet potatoes.....	.....	245,000 bus.	218,250
Sorghum .....	94 gals.	Estimated.	350,000
Broom corn.....	.....	Estimated.	25,000
Corn fodder.....	.....	Estimated.	8,250,000
Pasturage.....	.....	Estimated.	30,000,000
Fruits and vegetables.....	.....	Estimated.	6,200,000
Total.....	.....	.....	\$ 187,455,376

To the above figures should be added the increment in value gained by consumption of crops in the production of beef, pork, mutton, wool, dairy products, poultry and eggs, horses, etc. The aggregate value of the soil products of Iowa for the year 1898 is not less than \$225,000,000.





**CLIMATE AND CROP BULLETINS.****SUMMARIES OF WEEKLY BULLETINS ISSUED DURING THE CROP SEASON,  
1898.****BULLETIN NO. 1, APRIL 12TH.**

The season opened early, and has been unusually favorable for farming operations and seeding; but cool, dry winds, with freezing weather at night, have retarded the germination of seed and the growth of vegetation.

A much larger area than usual has been planted in spring wheat in the northern and central districts, with the soil in fine condition, and it appears to be uninjured by the low temperature.

The seeding of oats and barley is nearly completed, except in the extreme north and in the eastern counties, where work has been delayed by excessive moisture. Reports from numerous localities indicate that some fields of early sown oats have suffered damage by freezing, and re-seeding has been necessary. The extent of damage, however, is not large.

More than the usual amount of grass seeding is being done, especially in the central and northern districts.

More than usual progress for the time of the year has been made in plowing and fitting the ground for planting corn.

Warmer weather and rains are now needed to push the germination of seed and start the grass. On the whole the season is much more early and promising than last year at the corresponding date.

Fruit is generally uninjured. The condition of farm stock is good.

**BULLETIN NO. 2, APRIL 19TH.**

The past week was generally favorable for progress in farm work, and for growth of crops. The first half was cool, but the excess of temperature of the last half brought the average above normal. Showers on the 12th and 13th were quite well distributed, the larger measurements being reported in the eastern districts. The high temperature the latter part of the week developed fine showers on the 16th and 17th, giving the central and western districts a considerable amount of moisture.

Seeding is completed, except in localities where the work was retarded by heavy rains. In the larger part of the state spring wheat, oats and barley are coming up in fine condition, and the work of preparing the ground for planting corn is well advanced. With warm weather planting will be commenced before the close of April.

Grass is making a fine start, and reports indicate that pastures will afford support for stock earlier than usual. The general outlook for winter wheat is much better than early reports indicated. The season is early and prospects are flattering.

## BULLETIN NO. 3, APRIL 28TH.

The past week has been cool, with general deficiency of sunshine; but no damage resulted from the frost or low temperature. The rainfall was well distributed, and sufficient for the present needs of all crops. In portions of the southeast district farm work has been seriously retarded by excessive moisture. In the larger part of the state the rainfall was much needed, and it came in a form to afford the largest measure of benefit to grass and grain crops. The soil is generally in the best possible condition for the germination of seed and for planting.

Good progress has been made in plowing, and with the early advent of warm weather corn planters will begin operations. On the whole the agricultural outlook was never better in Iowa in the closing week of April.

## BULLETIN NO. 4, MAY 3D.

The average temperature of the past week was slightly below the normal.

Light frosts were noted in many localities, but no damage has been reported. The amount of sunshine was somewhat less than normal.

The rainfall came in the form of light showers, quite well distributed, and generally ample for the present needs of crops. In the southeast district, where the soil has been too wet in the early spring, the conditions are somewhat improved, and plowing for corn is in progress. In more than four-fifths of the state there has been no excess of moisture, and the soil is in excellent condition for farming operations. Reports indicate that a large area is now in readiness for planting corn, and farmers are only awaiting warmer weather to start their planters. In numerous localities in the southern and central districts planting has been commenced, and even in the northern districts a few have ventured to begin that work.

Grass and grain crops are generally reported in good condition, showing an excellent stand. Pasturage is coming on finely, and in many sections it is ample to support stock. Fruit blossoms are somewhat belated by cool weather, but the prospects are flattering.

The storm on Saturday evening developed severe local squalls, with hail and some indications of tornadoes in the northwestern section of the state, resulting in considerable damage to buildings, and possibly some injury to persons.

## BULLETIN NO. 5, MAY 10TH.

The week has been unseasonably cool, with a large excess of cloudiness. Numerous light showers with cold winds checked growth of vegetation and retarded field work during the larger part of the week. Conditions were generally more favorable on Friday and Saturday, and some progress was made in farming operations.

All reports indicate that wheat, oats, barley and rye are in fairly good condition, giving promise of average yields. Grass is generally doing well, though not making rapid growth. The season has been quite favorable for germination of clover, timothy and blue grass seed.

A good beginning has been made in planting corn in all districts, and with favorable weather that work will be pushed rapidly during the coming week. It is probable that some replanting will be necessary in fields that were planted before May 1st.

Fruit trees are rapidly coming into full bloom in the northern districts, and there are no reports of damage from the effects of light frosts on the mornings of the 6th and 7th.

The season of germination and blooming is later than the average, but farm work is well advanced except in the southeast district.

BULLETIN NO. 6, MAY 17TH.

Unseasonably cool weather prevailed during the past week in the larger part of the state, with considerable cloudiness. Light frosts are reported, but no damage resulted to vegetation, except checking its growth.

The rainfall was ample in all parts of the state, with some excess in the southeast district, where dry weather is greatly needed.

In the larger part of the state, however, the weather conditions were favorable for field work, and for the growth of wheat, oats, barley and grass. Except in the extreme southeastern counties corn planting has been vigorously pushed, and in portions of the central and northern districts it is nearing completion. The soil is generally in first class condition for reception of the seed, and the well-distributed rainfall of the 14th was timely and beneficial. The coming week will probably bring this work to a practical completion.

BULLETIN NO. 7, MAY 24TH.

The past week was warmer than usual, with a large excess of rainfall and general deficiency of sunshine.

All sections were abundantly watered, while in portions of the southern, southeastern and eastern districts the amount of rainfall was very heavy and detrimental to farming interests. The southeast district appears to have suffered most in this respect, the soil being saturated throughout the season. The station at Keokuk reports an excess of nine inches of precipitation since January 1st. Under such conditions field work has been greatly retarded in that section.

But probably three-fourths of the state has not as yet received an excess of moisture. In many localities some detriment resulted from heavy showers, which washed the soil considerably in fields recently planted.

In all sections corn planting was somewhat retarded by the frequent showers, but in the northern and central districts the work is nearly completed. Reports indicate that the seed is good and germination is quite satisfactory. In early planted fields the stand is promising, and cultivation is in progress.

The wet weather has been generally favorable for grass, wheat, oats, rye and barley.

BULLETIN NO. 8, MAY 31ST.

This has been a fine growing week—the best of the season—with almost ideal weather conditions in the larger part of the state. The average temperature was above normal, with abundant sunshine and ample rainfall in all districts. The showers were generally light, and in four-fifths of the state there is no complaint of excessive moisture.

Corn planting is practically completed, except in the southern and southeastern counties, wherein work was retarded by heavy rainfall. In those counties the soil conditions are much improved and farm work is

being pushed as rapidly as possible. In more than three-fourths of the state the condition of the corn crop is fairly good and much more promising than at the corresponding date in 1897. Generally a good stand has been secured, and less than the usual amount of replanting has been found necessary. The work of cultivation is in progress in all districts.

Grass is unusually heavy in meadows and pastures. Spring wheat is doing notably well. Oats and barley are making heavy growth, and the chief drawback is liability to damage by excessive growth.

An abundant hay crop is practically assured.

#### BULLETIN NO. 9, JUNE 7TH.

The daily mean temperature of the past week was from 3° to 5° above the normal in all districts. The heaviest rainfall of the week came on Saturday and Sunday, the 4th and 5th, and there were from four to five fair days for field work.

The conditions were favorable for the rapid growth of vegetation, and the weeds as well as crops responded to the quickening impulse. Fair progress has been made in the cultivation of corn, and in some favored localities the second plowing is in progress. Where the rainfall has been excessive, and in undrained fields, the crop is weedy. But in the larger part of the state corn has made a good stand, and its condition is fairly satisfactory. In the southeastern counties, where planting had been retarded by continued saturation of the soil, the work of planting was pushed vigorously during the week; but the acreage of corn will be materially decreased in that section.

Reports from all districts indicate that on rich lands oats may suffer material damage from excessive growth. In many localities the crop is already badly flattened. Wheat and barley are liable to suffer considerable injury from the same cause. Drier weather is needed for the normal development of all grain crops.

Conditions have been unusually favorable for pastures, meadows, new seeding of timothy and clover, flax, the potato crop, and small fruits. On the whole the crop situation is quite promising.

#### BULLETIN NO. 10, JUNE 14TH.

The past week was warm and excessively wet, with a very small percentage of sunshine.

All sections report copious showers, and in numerous localities there were phenomenal downpours that caused considerable damage by washing the slopes and flooding the bottoms. The heaviest amounts reported fell in Adair county, 8.58 inches in Fontanelle, and 10.57 in Greenfield from the 4th to 10th inclusive. Following are some heavy measurements reported at other localities: Clinton, 6.56 (for week ending Sunday); Marshalltown, 3.99; Parkersburg, 5.50; Fairfield, 3.39; Albia, 4.28; Des Moines, 3.46; Newton, 3.35; Waverly, 5.52; Toledo, 3.15; Boone, 3.10; Ames, 2.91; Mapleton, 3.75; Sioux City, 3.05; Thurman, 5.50; Lamoni, 3.58; Mt. Ayr, 3.09; Ft. Dodge, 3.33; Grundy Center, 4.17; Humboldt, 3.85; Allerton, 3.16 inches.

The effects on crops have been more or less damaging in all districts. In the larger part of the state the soil has been too wet for field work, and where the cultivation of the corn crop has been suspended, weeds and grass have made rapid advancement. Probably the acreage of this crop has

been slightly reduced by washing out and flooding. But with dry weather and normal conditions in the future, corn will make a rapid recovery and produce a good yield.

Spring wheat, oats and barley are very rank, and these crops are in imminent danger of heavy damage by lodging and rust. They are going down in all sections, and nothing but a radical change in weather conditions can save them from almost total failure.

Grass and potatoes are doing well. The wet weather has caused some timothy and clover to lodge; but the hay crop will be very heavy.

The burden of vegetation of all kinds is probably the heaviest that was ever seen in Iowa in the middle of June. The output of vegetable life, in all its varied forms, has certainly never been exceeded in this state, so early in the season, and in this enormous bulk is the chief danger to the yield of the harvest.

#### BULLETIN NO. 11, JUNE 21ST.

The past week averaged slightly cooler than usual, and there was less than the normal amount of sunshine. The rainfall was light in the larger part of the state, only a few localities reporting an excess.

The weather conditions were generally favorable for field work, and fairly good progress has been made in cleaning out the weedy corn fields. On all naturally well drained or tilled lands the condition of the corn crop is quite satisfactory,—better in fact than an average. On low, moist ground a small percentage has been ruined, and the extent of the loss in acreage will depend upon the weather in the near future. With the return of normal conditions, the corn fields may be speedily cleaned out, and the outlook for that crop will be very promising.

Spring wheat, oats and barley, are heading out. In all districts reports show that the growth is rank and the grain considerably lodged. The extent of damage from this cause cannot as yet be determined, but evidently it will be materially reduce the condition of these crops below the estimates made June 1st.

Cutting clover is in progress in many places, and timothy is nearly ready for the harvest. The flax crop is quite promising. Potatoes have made unusual advancement. Pasturage is extra fine.

#### BULLETIN NO. 12, JUNE 28TH.

The temperature of the week was high, with an abundance of sunshine. The rainfall was seasonable in amount, except within a limited area in the southwestern district, where considerable damage was caused by a heavy shower on the night of the 21st. Severe wind squalls swept over the central belt on the night of the 24th, causing additional injury to wheat and oats in fields where the growth is rank.

Generally, however, the weather conditions were highly favorable for farming operations and the advancement of all crops. The corn fields show satisfactory progress in cultivation, and the bulk of the crop is well cleaned and in a promising condition. At the close of another favorable week the work of cultivation will be practically completed, except in some of the southern counties where the work was delayed by excessive rains.

Winter wheat and rye are about ready for the reaper, with good prospects. Spring wheat, oats and barley are heading; and the outlook for these crops is made uncertain by their heavy growth and tendency to lodge.

The hay harvest is in progress, with very heavy yields reported in all sections. Potatoes, garden truck and small fruits are doing notably well.

BULLETIN NO. 13, JULY 5TH.

Seasonable weather conditions prevailed generally during the past week and good progress has been made in farm operations and in the growth of crops. The cultivation of corn has been pushed to a practical completion in nearly all sections of the state, and this crop is being laid by in a remarkably promising condition in respect to size, color, stand and freedom from weeds.

The hay harvest has progressed fairly well, except in some localities in the northern districts where the crop was injured by showers. Spring wheat, oats and barley are making good progress toward maturity, and have not lodged to the extent that was anticipated.

The harvest of winter wheat and rye is in progress, and some fields of barley are about ready to be cut. There are some reports of damage to winter wheat by rust and insects.

BULLETIN NO. 14, JULY 12TH.

The past week averaged slightly cooler than usual. The rainfall was variable and generally light; but in a few localities heavy showers occurred. At Thurman, Fremont county, the rainfall on the 6th and 7th amounted to 9.70 inches, causing heavy damage on the bottom lands.

The cooler weather was favorable for small grain crops, checking the tendency to rust, and the conditions were generally favorable for work in the harvest fields. Haying is well advanced in all districts, with heavy yield, generally secured in good condition. Winter wheat and rye are mostly in shock, and threshing operations are about to begin. Spring wheat and oats are filling well, and early sown fields are nearly ready for the harvest. Allowing for all damage by lodging and rust, these crops are likely to bring about an average yield.

BULLETIN NO 15, JULY 19TH.

Bright, warm days, cool nights and no rainfall except light showers in a few localities in the western districts were the special features of the past week. It was a full week of ideal harvest weather, which has been well improved in securing the matured crops in fine condition.

The harvest of fall wheat and rye is practically completed and threshing is in operation. Barley is mostly in shock. In the southern section the bulk of the oats crop has been cut, and the harvest of early sown fields in the central and northern sections is in progress. The ripening of oats has been hastened by dry weather and rust on the blades, which will tend to lighten the yield to some extent. The ripening of spring wheat has also been hastened by the same cause, and the harvest of that crop is begun in various localities.

Rain is needed in all sections for pastures, potatoes, garden truck and corn, though the latter crop is not generally suffering from lack of moisture. Flax is an excellent crop. A very large amount of good hay has been secured in fine condition.



## BULLETIN NO. 16, JULY 26TH.

Dry and hot weather prevailed generally during the past week. The midsummer drouth is still unbroken, though its severity has been somewhat mitigated by local showers and high winds on the nights of the 19th and 24th. In the larger part of the state, however, there is urgent need of copious rains for the relief of corn, potatoes and pastures. The severe and widely extended wind squalls on the 19th inst. caused quite serious damage to small grain in shock and stack; and corn was also injured to some extent.

Corn is doing as well as could be expected, but the crop is at a critical stage, and there is danger of serious injury unless relief is afforded within a few days. The extent of damage already suffered can not as yet be estimated.

In the southern and central sections small grain has been generally put in shock, and the work of stacking and threshing is in progress. In the northern section the cutting of spring wheat and oats is nearing completion, and early-sown flax is being harvested. The reports indicate variable returns from threshing but the average will be above the output of recent years.

Late potatoes are suffering material injury by the drouth.

## BULLETIN NO. 17, AUGUST 2D.

During the past week substantial relief has been afforded to the crops that were beginning to suffer from the effects of extreme heat and drouth. Fairly well distributed showers and cooler weather, with copious dews, have been very beneficial to corn, potatoes, grass and vegetables. The damage caused by high winds in various localities has been immeasurably overbalanced by the good effects of the refreshing showers and cooler temperature.

The corn crop has received the largest share of benefit, and, making due allowance for all injury by hot winds and severe squalls, the present general condition of the crop gives promise of a full normal yield, if seasonable weather prevails the balance of the season.

The potato crop has been materially shortened, and needs more rain in the near future to prevent further damage.

In the grain fields stacking and threshing are in progress. Reports of yield give promise of more than an average output of wheat, rye and barley, and the oats crop is better than early reports indicated.

The crop of apples and plums will be very light. Grapes, watermelons and tomatoes promise an abundant yield.

## BULLETIN NO. 18, AUGUST 9TH.

The past week was cooler than usual, and generally showery. The average temperature ranged from 3° to 5° below the normal. The showers extended to all parts of the state, but the amount of rainfall was widely variable, ranging from less than an inch to above five inches. Phenomenally heavy measurements are reported from the west central, northwest and north central districts.

The drouth is broken, with great benefit to corn, late potatoes, pastures, and other late maturing crops. Threshing and stacking operations were delayed, and grain in shock has been in danger of damage by wet weather.

The reports generally have a more cheerful tone in relation to the corn crop, which with favorable conditions in the future now gives promise of a full average output for the state at large. Threshing returns, so far as received, indicate above an average yield of wheat, rye and barley. Oats variable, but likely to make an average.

BULLETIN NO 19, AUGUST 16TH.

The past week was somewhat cooler than usual, the daily mean temperature being from 2° to 4° below the normal. It was generally dry the larger part of the week, and favorable for threshing and stacking, and good progress has been made in securing the grain crops.

Corn has made fair progress, though the nights have been too cool for its rapid growth. Generally, the crop is more advanced than at the corresponding date last year; but it is in all stages of growth, from the silk to roasting ears. In many early planted fields these differences are noted in the development of the ears, resulting from the reviving influence of the rains following the drouth.

In response to inquiries as to the date when the corn crop will be safe from damage by frost, quite variable opinions are given by crop reporters. The condition of the crop is variable, resulting from local differences as to time of planting and the weather conditions during the period of cultivation and growth. The average opinion seems to indicate that the more advanced corn will be fairly well matured by September 10th, the larger part of the crop will be practically safe by September 25th, and the belated portion will require all of September without killing frost to reach full maturity. In this state the average date of first killing frost is later than the first of October. So, with normal weather conditions, the corn crop is well assured, and for the state the total output will be very close to the average of recent years, and possibly above.

BULLETIN NO. 20, AUGUST 23D.

The average temperature of the past week was a little above the normal. The rainfall was quite unequally distributed, being generally very light in the western districts, and phenomenally heavy in considerable portions of the eastern and central districts, the larger measurements reported ranging from 2 to 4 inches. Several local wind and thunderstorms caused some injury to crops, but on the whole the showers were timely and beneficial. The heaviest damage was suffered by grain in shocks and in poorly constructed stacks.

The corn crop has made good progress, and, except within a limited area there is ample moisture to bring it to an early maturity. The larger number of reports as to the condition of corn are quite favorable, though in some sections the crop is reported to be somewhat below an average.

The rains have greatly improved pastures, and the soil is in good condition for fall plowing, which is in progress. Late potatoes are also receiving a measure of benefit.

Threshing small grain is progressing, with numerous favorable reports as to yield and quality of grain.



## BULLETIN NO. 21, AUGUST 30TH.

The week was warmer than usual, with very light rainfall except in scattered localities.

The conditions were favorable for farm work, and good progress has been made in threshing small grain and grass seed. Considerable progress has been made in fall plowing, except in sections where the soil is too dry, and in some localities a beginning has been made in sowing fall wheat and rye, with prospects of an increase in the acreage of these crops.

Corn has made unusual advancement in the last half of August, and there has been a corresponding shortening of the time required to place it beyond danger from frost. In some localities the early planted fields are being cut, and a considerable portion of the crop will be practically safe by the 15th of September. With normal weather conditions throughout the coming month the late planted portion will reach full maturity.

Very conflicting reports are received as to the condition of corn, the estimates depending upon the point of view of the crop reporters. It is certain that the midsummer drouth materially cut down the total yield of what at one time promised to be the largest crop ever grown in this state. But allowing for this reduction of prospective yield, the fields to-day carry a heavier average burden of corn than was in sight at the corresponding date last year.

## BULLETIN NO. 22, SEPTEMBER 6TH.

The past week was the warmest of the season, the daily mean temperature ranging from 8° to 10° above the normal. The protracted heated term culminated in showers on the 3d and 4th, which were quite widely distributed, affording a large measure of relief to the people and the suffering vegetation.

Corn has been forced toward maturity somewhat too swiftly for the perfect development of the late-planted portion of the crop, and in some counties the hot, dry weather has unquestionably caused some damage. But on the whole, corn has done notably well, and a very large percentage is now fairly well matured and in condition to be cut up or to withstand a sharp frost. For all of the crop it would better to have seasonable weather, without frost, until the latter part of this month. Considerable progress has been made in cutting, especially in the dairy districts where the farmers fully appreciate the value of corn fodder.

More than the usual amount of plowing has been done, and seeding fall grain is in progress. The pastures need rain, and in some sections it is much needed to facilitate plowing.

## BULLETIN NO. 23, SEPTEMBER 13TH.

The past week was unseasonably cool, with less than the usual amount of sunshine. The daily average temperature was from 5° to 7° below the normal. Light frosts were observed in many localities, but no damage resulted. The amount of rainfall was generally ample for present needs, and in the larger part of the state the pastures have been improved and the soil is moist enough for fall plowing. Seeding of fall wheat and rye is in progress, with prospective increase in the acreage of wheat.

The greater part of the corn crop is now sufficiently mature to withstand frost, and a considerable portion is being cut and shocked. The ripening

of late corn has been retarded, but it is doing fairly well, and with normal weather in the near future it will soon be safe. Late potatoes need two or three weeks to ripen.

BULLETIN NO. 24, SEPTEMBER 20TH.

The first half of the week was cool and showery, and the last half warm and dry. The rainfall was generally sufficient for present needs in the greater part of the state, affording ample moisture to improve the pastures, replenish the streams, and to put the soil in good condition for plowing. The central and southern districts received the larger amounts of rain, and it was much needed in the southwestern counties.

Fall plowing is now well advanced in all sections, and much seeding of fall grain has been done under most favorable conditions.

The corn crop is now practically beyond danger of material injury by frost, though some of the late-planted fields will mature in better condition if normal weather prevails through the balance of the month. The crop is generally more fully matured in the northern half than in the southern half of the state, and with drying weather much of the crop will be in condition to crib early in October. A considerable area has been cut and shocked, especially in the eastern districts.

On the whole, this has been a season of bountiful production in this highly favored state.

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LOSSES BY LIGHTNING.

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[FROM SEPTEMBER MONTHLY REVIEW.]

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Blanks for the collection of statistics of losses due to lightning were sent out last spring to agents and adjusters of insurance companies, and to others who were willing to aid in this undertaking. The inquiries cover a wide range, relating to the losses and the conditions under which they occurred. The responses have not been as general and comprehensive as we hoped to receive, but perhaps they were as numerous and specific as could be expected at the inception of this work.

Up to date, October 1st, we have received 186 reports, mainly from adjusters of losses of insurance companies doing business in this state.

These reports give details of the loss or damage by lightning of 37 buildings, and the killing of 266 head of live stock, including 37 horses and mules, 32 sheep, 40 hogs and 157 cattle.

The aggregate loss on buildings burned or damaged, with their contents, is \$17,336. Of the number of buildings struck, there were 28 barns and 9 houses. Of the dwelling houses only 2 were burned, causing a total loss of \$1,000; and 7 were struck and damaged to the amount of \$180. Barns suffered much more heavily than houses, 17 of the 28 being consumed with their contents, the loss amounting to \$16,156. Of all the buildings struck, 2 were reported to have been provided with lightning rods, and these were barns. The rods were of rough iron, but we have no information as to the manner of attachment, or the ground connection. One of the rodged barns was only slightly injured, and the other was consumed.

The reports show that 14 barns were struck by lightning in the months of July and August, and of that number 11 were totally consumed; whereas, in May and June, 12 barns were struck and only 5 were burned. This affords evidence of the fact that barns suffer greater loss after the hay and grain harvest, when they are filled with the products that generate large quantities of vapor. Records show that of the number of barns struck before harvest only 41 per cent were consumed, while after harvest 78 per cent were burned by the fiery bolts. And yet there was greater electric energy displayed in the early, than in the latter, part of the season, as shown by the fact that the live stock killed in the months of May and June, were double the number reported in July and August.

These reports show the interesting fact that of the 266 head of live stock killed by lightning, 118 were found in close contact with wire fences; and also that these wire fences were not provided with ground wires. That is to say, over 44 per cent of the losses of live stock may have been caused by contact with wires charged with electric force.

Unquestionably, wire fences, as now constructed, serve as death traps to live stock, causing a vast amount of loss every year. And it is also quite evident that a considerable percentage of danger may be avoided by use of ground wires at frequent intervals, in the construction of wire fences. In some of the reports it was stated that there were evidences that the lightning struck the fence at a considerable distance from the point where the stock was killed.

As an illustration of this matter, Mr. J. R. Chandler, of Dexter, reported the loss of a flock of 32 sheep, on the premises of G. F. Lenocker, in Madison county, June 22d. They were found lying along the wire fence, against which they were driven by the storm, and it was observed that the lightning struck the fence 20 rods from the place where the sheep were killed. That deadly bolt might have been sent into the earth within a few feet of where it struck. This emphasizes the need of careful observation of all the conditions connected with losses of that kind, to discover the causes and possible means of prevention.

Of the 186 destructive strokes reported, we find that 55 occurred on low, moist ground, and in 41 cases near timber or trees. The others were on dry land, and in open fields.

It is hoped that during the next season we may awaken sufficient interest to bring out a largely increased number of reports. By the systematic collection and tabulation of the details, and a careful study of all the facts that may be gathered in this form, we may possibly gain some knowledge of practical utility as well as of scientific interest.

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## LOCAL CLIMATIC CHANGES.

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[MONTHLY REVIEW U. S. WEATHER BUREAU.]

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A correspondent in Northfield, Mass., desires our opinion on the question: "Were the winters of fifty years ago much colder, or were the snowfalls deeper than at present? The opinion is widely held that the winters were colder and the snowfalls deeper, but I can find nothing to warrant the belief

except that in the first part of the century a much larger percentage of the population lived in the hill towns or in the interior, which are both colder than the valley or the coast towns."

On the general question as to the appreciable changes in climate, the editor's opinion is that there has been no such change in any respect whatever so far as meteorology proper is concerned. If we divide our records of the weather recorded in North America since the days of Columbus into two periods, viz., before and after the year 1800, we shall find that every peculiarity, such as remarkable storms, winds, rains, floods, frosts, etc., recorded in the current century can be matched by a corresponding remarkable event before the year 1800. The popular impressions alluded to by our correspondent result almost entirely from the imperfections of our records, and especially of our memories. There is a large class of persons whose habits of thought are so crude that when they experience any very remarkable weather they jump to the conclusion that the climate has changed, forgetting that they themselves have had such a limited personal experience that they are not fair judges of the weather over the whole country or of the climate of a century.

Our correspondent seems to suggest that a certain change in the habits of the people, such as the removal from the interior to the coast, or from forests to prairies, or from country to city, or vice versa, will partly account for widespread errors in respect to climate. The suggestion is excellent, but the editor would be inclined to interpret the phenomenon somewhat differently. The general movement of the population in the past century has been from the Atlantic states westward, and from the country to the city, or quite opposite to the movement suggested by our correspondent. In fact, we find no real agreement in the so-called popular traditions with regard to the weather. We have met with quite as many persons who think the winters are more severe as with those who think the winters are less severe than formerly. Everything seems to depend upon how and where the "oldest inhabitant" lived when he was a boy as compared with his present condition. If he moved from a farm on a windy hilltop in the country down to a cosy house in the village, the climate seemed to him to have improved. If he moved from the milder climates on the coast in his youth to the severer climates in the interior, he was, as a boy, struck with the great change, and the impression still remains with him that those winters were severer than now. If he has lived continuously in a large city like New York, where the growth of tall houses, the increased smoke, and diminished sunshine, have completely changed the climate, and where these combined with the changes in the mode of living, especially the abolition of the open wood fire, have rendered the human system vastly more sensitive, he finds that the inequalities of climate are greater than formerly.

From a hygienic point of view "the climate" includes everything that affects the health and comfort of the body. The meteorological climate that agrees perfectly with one person may be entirely too severe for another. Our remembrance of our physical sensations is not a safe criterion when judging of climate. Our remembrance of an occasional storm or winter is not a safe guide in comparing the past with the present. Our records of deep snows are too fragmentary to give anything more than a general conviction that there has been no material change in the snowfall. Our

records of extreme low temperature are liable to be in error several degrees by the ancient use of very imperfect thermometers, and are almost certain to be exaggerated if the thermometers were placed in valleys or lowlands where cold air settles on still, clear nights, so that we must use great caution in interpreting these records; differences of 5° to 10° degrees, and even 20°, have occurred between the minimum temperatures recorded by weather bureaus and voluntary observers located within a few miles of each other, owing to the combination of these two sources of error.

Remarkable rains and snows are usually quite local phenomena; there have been several remarkable cases of this nature in certain portions of New England and the middle Atlantic states within the past ten years. Similar remarkable cases occurred in other portions of these states fifty years ago, and equally remarkable cases occurred in still other portions just before 1800. If there has been any change in the climate of Northfield, Mass., it is because it lay within some one of these regions of extraordinary rain or snow on one occasion and not on another. Such a change of climate at one spot is no criterion by which to judge of changes at other places 100 miles away. The average climate of New England, so far as the weather is concerned, has not appreciably changed since the days when her oldest forest trees were young saplings, and that carries us back nearly five hundred years.

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## CLIMATE AND SOIL FERTILITY.

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### HEAT AND ARIDITY AS IMPORTANT FACTORS IN THE PRODUCTION AND MAINTENANCE OF A FERTILE SOIL

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A recent bulletin issued by the experiment station at Brookings, South Dakota, presents some interesting facts and theories relative to the causes which have operated in the production of the wonderfully fertile soil of that portion of the great central basin. We copy the following extract of this valuable report, and append thereto brief comments:

All that portion of South Dakota lying east of the Missouri river is covered by what is known as drift or boulder clay, except a few small isolated areas. This formation varies in depth from a few feet to two or three hundred feet, and when the entire mass of the deposit is considered it is of a remarkably uniform character throughout the state. Its chief characteristic is a light yellow color, with numerous small, calcareous masses and more or less boulders, stones and pebbles in the subsoil, gradually merging into a dark brown or black loam on the surface. This dark color is due to the presence of decaying vegetable matter and the action of the elements.

Everywhere drift soils are recognized as containing practically in exhaustible quantities of the elements of fertility, but in most glacial areas the ice-sheet, in its movement from the north, encountered so many exposed ledges of rock that the material it deposited was composed largely of boulders that had not yet been reduced to soil; so that, while drift soils are universally recognized as fertile soils, they are usually so stony as to be difficult to till. Fortunately for this state, the character of the country to the north of us for hundreds of miles was such that little raw material in the form of rocks was added to the moving mass of ice and soil, but the materials which it did bring had been so thoroughly mixed up and ground down by the time it reached its present location that it is composed almost entirely of thoroughly disintegrated soil material. Thus we have all the

advantages of a drift formation, with far less stones than are usually found in drift or boulder clay.

In addition to the foregoing there have been other very potent factors in producing a soil of great uniformity and remarkable fertility throughout this region. Most important of these is the fact that this has been a region of light rainfall for a great length of time. We have become accustomed to associate the ideas of humidity and fertility, on account of the very luxuriant growth of vegetation which is found in those countries having a heavy annual rainfall. But the very same causes that produced the heavy growth of forest and underbrush will, as soon as that forest growth is removed, begin to carry away, not only those elements of stored up plant food in the soil, but in many instances the soil itself; so that in many of the humid districts the luxuriant forest areas of one generation become the washed and worthless hillsides of the next. No such wasting effects have been experienced upon our open prairies, although they have been unprotected by forest growths for ages; but, on the contrary, there has been a steady increase in the store of available plant food as a direct result of those chemical and physical changes which are constantly going on in the soil. Had this been a region of heavy rainfall, the salts which result from these changes would have been washed off or leached out as fast as formed, and no such store of available plant food would have been possible.

The influence of temperature in soil formation is also an important one. It has an effect upon both the chemical and physical changes which take place in the soil. Other conditions being equal, all chemical changes taking place in soil formation are accelerated by high and retarded by low soil temperatures. The very high soil temperatures which have been observed in this region during the summer and fall months have contributed in no small measure to the reduction of the soil to its present condition. The effect that temperature has upon the physical changes that take place in soil formation is largely due to expansion and contraction. There are but few regions that have experienced such frequent, sudden and violent changes as this. So it seems probable that the temperature conditions of this climate have had a beneficial effect upon the physical, as well as the chemical, changes which are necessary for the production of fertile soil.

The all important question to be considered is how to till the soil so as to place it in the best possible physical condition for plant growth. The object of all tillage is to secure the proper arrangement of the soil particles with relation to each other. It is true that tillage has a very beneficial effect in the destruction of weeds, but any system of tillage that will keep the soil in the best physical condition will also keep the weeds down, so that destruction of weeds does not need to be considered.

There is probably no locality where the question of tillage needs more careful study, nor where it promises greater rewards. We have everything that is needed for a rich, prosperous agricultural state; a soil of particularly inexhaustible fertility, easily and cheaply worked, favorable conditions of temperature and sunshine, and, if properly husbanded, sufficient rainfall. That there is frequently an insufficient supply of moisture to produce a full crop under the wasteful and oftentimes thoroughly shiftless system of farming which has been so extensively practiced in the past, admits no denial. That the normal precipitation is sufficient for the production of good crops under a proper system of tillage, we believe can be demonstrated. What the best system of tillage is, we are not yet prepared to say.

Much of the foregoing extract relating to the effects of geologic forces and climatic conditions is applicable to a large portion of the upper valley lying westward of the Mississippi river. In all this region the thoroughly disintegrated drift formation is capped by a deep layer of dark loam that is marvelously rich in all the elements of fertility. And unquestionably this wonderful surface deposit of available plant food is a direct product of the



climatic conditions that have prevailed in the vast period of time since the glacial epoch.

In our deep, rich soil we find irrefutable proof of the statement that both heat and aridity have been important factors in its production. The rainfall must have been relatively light for a very great length of time; and the ready inference is that there has been no essential change of general climatic conditions for many centuries. This tendency toward aridity for so large a portion of the year is a powerful conservator of the vast store of fertility that is the heritage of the people of this favored region. As a rule we have ample rainfall for the production of an abundance of the staple crops, and not so much as to wash off and leach out the salts and other essential elements of our fertile soil.

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### THE ALMANACS AND THE WEATHER BUREAU.

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[MONTHLY WEATHER REVIEW, JANUARY, 1898.]

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During the past few months the editor has noticed a number of newspaper paragraphs discussing the relative merits of the weather predictions published daily by the officials of the weather bureau for one or two days in advance, and those published by the numerous "farmers' almanacs" published several months, or even a year, in advance, and sold in large numbers throughout the country. The predictions of the weather, as made by the weather bureau, are based entirely upon the daily maps that show the actual condition of the atmosphere, as reported by reliable observers throughout the country. On the other hand, the predictions in the various almanacs are founded upon a variety of principles among which are the following:

*First.*—The most conservative and rational almanacs are those that compile from the records of many past years a table showing what sort of weather has prevailed most frequently on the respective days of the year.

*Second.*—The least rational almanacs are those that pretend that the weather is controlled by planetary combinations and stellar influences, therefore, such predictions are properly said to be based upon astrology.

*Third.*—An intermediate class publishes predictions based upon the probability of spots upon the sun, thereby assuming it to have been demonstrated that the solar spots control terrestrial weather.

*Fourth.*—The least scientific system of preparing the almanac predictions was explained to the editor many years ago by a gentleman whose almanac made the greatest pretensions to high scientific accuracy. This gentleman stated that on certain days he felt endowed with a certain ability or inspiration. These were his weather making days, on which he sat down, and with the most absolute confidence in the accuracy of his work, wrote up the weather for the coming year, continuing at the work for a considerable time until the inspiration seemed to leave him, whereupon he necessarily stopped and delayed resuming the work until again filled with the spirit of divination.

Doubtless some almanac makers adopt a combination of the four preceding methods, but, in general, these seem to be the principles most widely

recognized in the long-range predictions of the almanacs, except only in all cases the authors make free use of a system of general and rather indefinite terms that will apply just as well to a thunderstorm, a hurricane, or an earthquake. The warning "Look out for something very unusual about this time" is, of course, not a meteorological prediction, and not nearly as definite as the railroad signboard "Look out for the engine when the bell rings."

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## EVAPORATION FROM THE OCEAN.

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[MAURY'S PHYSICAL GEOGRAPHY OF THE SEA.]

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The mean annual fall of rain on the entire surface of the earth is estimated at about five feet. To evaporate water enough annually from the ocean to cover the earth, on the average, five feet deep with rain; to transport it from one zone to another, and to precipitate it in the right places, at suitable times and in the proportion due, is one of the offices of the grand atmospherical machine. The water is evaporated principally from the torrid zone. Supposing it is all to come thence, we shall have, encircling the earth, a belt of ocean 3,000 miles in breadth, from which this atmosphere evaporates a layer of water annually sixteen feet in depth. And to hoist up as high as the clouds and lower down again all the water in a lake sixteen feet deep, and 3,000 miles broad and 24,000 long, is the yearly business of this invisible machinery. What a powerful engine is the atmosphere! And how nicely adjusted must be all the cogs, and wheels, and springs, and compensations of this exquisite piece of machinery, that it never wears out, nor breaks down, nor fails to do its work at the right time and in the right way! The abstract logs at the observatory in Washington show that the water of the Indian ocean is warmer than that of any other sea; and therefore it may be inferred that the evaporation from it is also greater. The north Indian ocean contains 4,500,000 square miles, while its Asiatic watershed contains an area of 2,500,000. Supposing all the rivers of this watershed to discharge annually into the sea four times as much water as the Mississippi discharges into the gulf (107 cubic miles, or about one-sixth of all the rain that falls on its watershed), we shall have an average annual evaporation from the Indian ocean of 6 inches, or .0165 per day.

The rivers of India are fed by the monsoons, which have to do their work of distributing their moisture in about three months. Thus we obtain .065 inch as the average daily rate of effective evaporation from this ocean. If it were all drained down upon India, it would give a drainage which would require rivers having sixteen times the capacity of the Mississippi to discharge. Nevertheless, the evaporation from the north Indian ocean required for such a flood is only one-sixteenth of an inch daily throughout the year. I estimate the total amount of evaporation that annually takes place in the trade-wind region generally at sea as not exceeding four feet.



## CLIMATE.

[DAVIS' ELEMENTARY METEOROLOGY.]

The average values of the atmospheric conditions of a region constitute its climate. The most important climatic elements are first, temperature; second, various forms of moisture, as vapor, cloudiness, and precipitation; third, wind, including storms. The pressure of the atmosphere is not a climatic element, and needs to be considered only in its association with the divisions of the wind system.

While annual averages were first considered in the definition of climate, more and more importance has come to be attached to the average of seasonal values, and to such special quantities as the average highest or lowest temperature or rainfall of a season or month. Even the extreme values are often included in climatic tables, in order to present as fully as possible the meteorological features of a district; but in so doing we approach the consideration of its weather. A full climatic account of a locality should include: for temperature—the monthly and annual means, the mean diurnal range for the several months, the mean and the absolute extremes for the year and months, the mean diurnal variability (the mean of the differences between the successive daily means), the average dates of the latest and earliest frost, the average number of days without frost; the average duration and value of cyclonic ranges of temperature in the several months; the mean intensity of sunshine in clear weather of the different months; the mean temperature of the soil at successive depths down to five or six feet: for moisture—the monthly mean absolute and relative humidity, the mean monthly evaporation from a water surface; the mean cloudiness and mean duration of sunshine in the several months; the mean monthly and annual rainfall, with additional data for melted snow in the winter months; the mean number of rainy and snowy days in every month, the mean frequency of rainfall in every month (number of rainy days divided by the total number of days), the average dates of latest and earliest snowfall, the average depth of snow on the ground at the end of every month; if possible, the proportion of rainfall received from general cyclonic storms and from local thunderstorms in the several months, and the mean diurnal variation of rainfall for the different months; the mean number of days with thunderstorms and with hail in the several months; for winds—the frequency of different directions for the several months, with the corresponding mean velocities, and indication of the frequency of calms and of exceptionally strong winds; the mean diurnal variation in direction and velocity for several months.

In regions like the eastern United States, the means of climatic elements in corresponding months of successive years vary so greatly that a considerable number of years is required to determine their true values. Hence the importance of maintaining weather records continuously under conditions as nearly constant as possible, in order to outlast the influence of dry or wet, warm or cold periods. It is hardly worth while to begin such records unless there is a fair probability of their continuance, and unless good instruments can be secured and properly exposed.





Denison.....	.62	1.86	1.74	5.17	4.24	2.95	3.74	3.00	3.29	1.65	1.00	.41	27.67	6	1893-1898
Denmark.....	1.46	1.98	2.32	2.53	4.47	5.85	3.33	3.52	2.80	3.83	1.87	1.94	35.39	13	1878 1898
Des Moines.....	1.35	1.20	1.45	3.04	4.65	5.19	3.89	3.19	3.08	2.93	1.62	1.69	32.53	21	1873-1898
Dubuque.....	1.68	1.50	2.26	3.06	4.11	4.97	4.27	3.09	4.07	2.69	1.98	1.73	35.40	26	1877-1899
Dysart.....	1.23	1.18	1.74	3.22	3.93	4.96	4.75	3.80	4.75	3.08	1.75	1.68	35.06	13	1873-1898
Elkader.....	1.50	1.10	1.78	3.16	3.71	3.89	4.11	2.85	3.91	2.74	1.73	2.23	32.50	20	1873-1898
Fairfield.....	1.76	1.36	2.12	3.05	6.03	4.39	3.28	3.71	2.78	2.87	1.96	1.64	34.94	14	1878-1898
Fayette.....	1.44	1.11	2.10	3.62	3.98	6.10	3.15	2.75	2.83	2.75	1.75	1.41	33.03	9	1890-1896
Ft. Madison.....	2.00	1.94	2.77	3.22	4.39	4.28	3.90	3.65	3.85	2.75	2.19	2.03	36.97	51	1848-1898
Garnavillo.....	1.03	1.11	1.28	2.00	3.25	3.72	5.27	3.29	4.55	3.21	1.08	1.06	30.85	7	1880-1826
Galva.....	.44	.33	1.27	3.60	3.55	3.58	3.43	2.90	1.96	1.14	1.17	.72	24.18	6	1843-1898
Glenwood.....	.28	.89	1.37	2.53	5.19	4.47	3.74	3.37	2.23	2.41	.91	.81	26.71	15	1875-1898
Grand Meadow.....	1.43	1.05	2.05	3.58	4.21	5.24	3.64	2.36	2.89	2.54	1.63	1.59	32.20	8	1891-1898
Greenfield.....	1.09	1.17	2.40	3.60	4.43	5.21	4.44	2.59	3.03	1.81	1.00	1.46	32.23	8	1891-1898
Grinnell.....	1.41	.77	1.53	3.73	4.57	4.98	2.87	3.82	3.04	2.87	1.53	1.20	30.87	9	1890-1898
Grundy Center.....	.75	.70	1.33	4.00	4.41	4.02	3.73	2.99	2.85	2.70	1.00	1.28	29.97	8	1891-1898
Guttenberg.....	1.14	1.17	1.88	2.33	3.55	5.17	4.62	3.61	3.87	2.34	2.01	1.89	33.58	16	1865-1885
Hamlin.....	.57	.56	.85	1.56	3.31	3.49	3.84	2.88	2.55	2.59	.85	.94	23.89	12	1877-1898
Hampton.....	1.23	1.17	2.01	4.13	3.76	4.97	3.33	3.03	2.87	2.67	1.79	1.35	32.11	9	1890-1898
Hawkeye.....	1.74	1.33	2.10	2.97	3.80	4.46	2.70	2.56	2.66	2.02	1.66	1.48	29.48	6	1892-1898
Hopeville.....	1.16	.88	1.73	3.87	4.84	4.20	4.26	3.04	3.16	1.86	.94	1.07	31.00	8	1891-1898
Hopkinton.....	1.58	1.20	1.99	2.63	4.25	4.20	3.67	3.97	4.68	3.56	2.09	1.88	32.50	18	1877-1898
Humboldt.....	.49	.64	1.52	4.03	3.68	3.61	3.14	2.83	2.10	1.76	.90	.60	25.30	6	1893-1898
Ida Grove.....	.32	1.00	.84	1.64	3.85	5.14	3.71	3.14	3.84	2.70	1.00	.94	28.62	7	1879-1887
Independence.....	1.30	1.04	1.74	2.44	4.01	4.80	4.29	3.14	4.29	2.37	1.41	1.35	33.21	33	1867-1898
Indianola.....	1.49	.70	.93	3.81	4.74	4.28	3.19	3.30	2.84	1.62	1.30	1.53	29.73	7	1892-1898
Iowa City.....	2.03	1.25	2.39	3.18	4.15	3.68	4.13	2.35	2.70	1.99	1.72	1.64	31.21	9	1890-1898
Iowa Falls.....	.91	.83	1.26	4.23	3.68	3.63	2.82	2.92	2.99	2.26	1.35	1.10	27.96	6	1893-1898
Keokuk.....	1.80	1.66	2.21	3.19	4.00	4.48	4.51	2.79	3.63	2.63	2.08	1.88	34.85	28	1871-1898
Keosauqua.....	1.83	1.23	2.49	4.62	4.73	3.94	3.82	3.35	5.13	1.47	1.29	1.48	35.27	7	1892-1898
Knorrville.....	1.39	.99	1.27	4.10	3.83	3.45	3.85	3.90	3.35	2.42	1.23	1.23	30.40	6	1893-1898
Larrabee.....	.64	.60	1.88	3.83	3.87	6.16	3.94	3.19	1.97	2.15	.95	1.14	32.33	9	1890-1898
Logan.....	1.19	1.16	1.87	2.96	4.39	5.51	4.86	3.88	3.06	2.37	1.06	1.30	33.65	33	1868-1898
Marshalltown.....	.84	.73	1.54	3.63	4.45	3.91	4.34	2.63	2.13	2.56	1.06	1.64	29.44	7	1891-1898
Mason City.....	1.36	.54	1.19	3.72	4.38	4.70	2.27	2.76	2.05	2.41	.99	.63	27.06	5	1894-1898
Maxon.....	.63	1.28	1.67	3.50	5.16	3.43	4.20	4.87	2.63	1.55	1.78	1.97	33.65	6	1891-1898
Maquoketa.....	1.71	1.18	2.44	3.22	3.96	6.34	3.19	2.78	2.78	2.96	1.56	1.64	34.25	6	1881-1898
McGregor.....	1.38	1.23	1.66	2.47	3.77	4.72	4.38	3.20	3.39	2.38	1.82	1.67	32.07	46	1850-1896
Mechanicsville.....	1.41	1.13	2.15	3.00	4.30	4.41	3.64	2.08	3.95	1.84	1.63	1.76	30.80	5	1893-1898
Monticello.....	1.61	1.71	2.39	2.68	3.87	4.46	4.14	3.66	3.78	2.75	2.25	2.23	35.52	44	1855-1898
Mt. Ayr.....	1.32	1.14	2.13	3.76	5.77	4.60	4.83	3.01	2.77	1.91	1.26	1.29	33.79	6	1892-1898
Muscatine.....	1.81	2.06	2.79	3.41	4.28	4.86	3.91	4.38	3.72	3.04	2.30	2.28	38.96	43	1846-1891

PRECIPITATION DATA—CONTINUED.

STATIONS.	Record in-cluded be-tween dates be-low.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Nashua.....	1.54	2.23	2.76	2.07	4.19	5.35	6.68	3.87	5.81	3.45	2.34	2.94
Newton..	.92	.97	1.35	3.50	4.50	4.06	3.19	3.55	2.30	2.56	1.87	1.27
Onawa.....	2.32	1.12	1.51	2.79	4.61	5.11	4.23	4.04	2.33	2.11	1.05	1.06
Osage .....	.92	1.17	1.45	2.90	4.09	4.22	3.40	2.74	3.38	2.57	1.48	1.31
Oskaloosa.....	.93	1.07	1.98	2.74	3.71	4.00	3.73	2.73	3.91	2.28	1.66	1.15
Ottumwa.....	2.50	1.13	2.10	3.88	4.87	3.40	4.25	3.25	3.36	2.53	1.63	1.79
Ovid .....	2.01	1.35	2.19	3.64	3.42	3.83	3.53	3.86	3.74	2.34	1.36	1.58
Panama.....	.36	.55	1.29	4.08	4.00	3.88	4.56	4.13	2.77	2.24	1.08	1.16
Rock Rapids.....	.63	.14	1.59	3.75	3.29	3.74	2.53	1.76	2.30	1.75	.99	.61
Sac City.....	1.11	1.06	1.61	3.37	4.18	5.09	3.73	3.32	3.09	2.23	1.16	1.24
Seymour.....	1.45	1.66	1.21	3.95	3.11	4.40	3.46	4.49	4.07	1.61	1.81	1.99
Sioux City.....	.69	.56	1.22	3.26	3.65	3.75	3.16	2.80	1.48	1.63	.89	.83
Sibley.....	.80	.38	1.17	3.48	3.36	3.95	3.01	2.03	2.39	1.90	1.06	.70
Smithland.....	.51	.65	.66	2.09	3.50	4.32	2.96	3.77	2.84	1.76	1.71	.62
Spirit Lake.....	.67	.28	.83	3.29	2.62	3.02	2.37	2.65	2.14	2.18	1.09	.59
Storm Lake.....	.81	.63	1.37	2.49	3.47	4.52	3.79	2.66	2.68	1.45	.79	.92
Toledo.....	1.00	.62	1.33	3.42	3.14	2.48	3.08	2.56	3.11	2.04	1.30	1.18
Vinton.....	1.37	.96	1.69	3.15	3.72	3.54	2.59	2.21	2.72	2.49	1.19	1.22
Villisca..	.72	.85	2.14	3.94	3.86	4.89	4.55	4.42	2.89	1.91	1.12	1.00
Washington.....	1.82	1.00	2.25	2.71	3.53	3.12	3.84	2.56	2.62	1.65	1.46	1.22
Waterloo .....	1.20	1.11	1.33	2.48	3.60	3.60	3.93	3.59	4.24	2.28	1.43	1.23
Webster City.....	1.13	1.05	2.13	3.38	3.36	3.63	3.46	2.60	1.70	2.40	1.20	1.31
Wesley.....	1.14	1.05	1.41	2.30	3.30	4.74	3.50	2.79	3.52	2.17	1.13	2.16
West Bend.....	.76	.92	1.70	3.42	2.81	3.83	2.98	2.59	2.16	1.38	1.56	.88
Winterset.....	1.11	.89	1.63	4.43	4.56	6.17	5.81	3.07	3.10	1.94	1.18	1.35
Means.....	1.22	1.06	1.75	3.20	3.97	4.26	3.68	3.07	2.99	2.28	1.42	1.28

MEAN TEMPERATURE.

Average monthly and annual mean temperature at various Iowa stations for the period of years named.

STATIONS.	STATIONS.												Record in-cluded be-tween dates be-low.		
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.		Means.	No. years.
Albion .....	11.6	17.3	28.7	45.8	58.4	66.9	70.9	69.0	59.5	49.1	29.7	17.1	42.0	6	1879-1884
Algona.....	14.2	19.1	30.7	48.0	58.4	70.0	73.6	69.3	63.6	48.1	29.4	20.4	45.4	7	1891-1898
Amana.....	14.4	20.8	31.1	48.4	59.6	69.6	73.7	70.3	61.9	48.5	32.0	21.8	46.1	23	1876-1898
Ames.....	15.8	22.4	32.4	49.1	59.0	70.0	75.0	72.0	63.6	49.9	31.8	21.8	46.9	19	1876-1898
Alta.....	15.0	18.2	29.6	47.4	57.6	69.1	73.4	70.0	64.6	49.1	29.0	21.6	45.3	8	1891-1898
Atlantic.....	18.4	23.9	33.4	49.0	58.4	69.8	72.8	70.6	65.7	50.2	32.5	24.9	47.4	8	1891-1898
Audubon.....	18.2	21.0	34.0	49.8	59.5	69.5	73.2	71.7	64.2	48.8	32.1	24.0	47.2	6	1893-1898
Blakeville.....	13.7	23.0	30.0	47.5	55.8	71.2	74.5	71.5	66.3	52.3	24.3	24.5	47.0	4	1890-1898
Belle Plaine.....	18.0	22.5	32.4	49.6	58.2	69.9	72.8	69.9	64.1	49.1	32.3	23.9	46.9	9	1890-1898
Bonaparte.....	21.6	25.4	36.4	52.0	62.3	73.1	75.9	74.1	68.8	54.2	36.2	26.8	50.9	8	1891-1898
Brookside.....	12.7	19.9	29.1	45.1	59.0	68.6	73.4	69.9	61.0	46.6	31.4	17.5	44.5	17	1862-1878
Carroll.....	18.5	20.7	31.2	48.8	58.5	70.0	73.1	70.2	63.9	49.4	31.1	23.3	46.6	9	1890-1898
Cedar Falls.....	16.4	19.7	32.6	49.6	59.1	70.6	73.4	71.7	65.0	50.5	31.1	23.4	46.9	8	1891-1898
Cedar Rapids.....	16.7	21.7	32.8	43.8	59.0	70.6	74.6	71.5	63.4	50.0	24.6	24.7	47.0	17	1882-1898
Centerville.....	21.5	22.7	40.7	53.4	62.0	72.0	76.5	74.0	68.8	51.5	27.0	20.3	51.0	6	1892-1898
Charles City.....	13.9	17.6	30.5	46.9	57.3	64.6	73.4	70.2	63.6	49.1	29.3	20.6	45.1	8	1891-1898
Clarinda.....	21.2	24.9	34.9	52.0	60.8	71.9	75.8	73.8	67.6	53.0	35.8	27.2	49.9	9	1890-1898
Clinton.....	18.7	23.7	26.7	50.9	60.9	71.5	74.1	72.1	65.4	51.2	33.6	26.3	48.7	8	1891-1898
College Springs.....	22.5	26.4	37.3	50.7	60.6	70.8	74.4	72.5	68.8	55.8	37.1	28.0	50.5	8	1892-1898
Corning.....	20.6	25.2	36.7	51.1	60.3	70.4	73.5	72.0	66.4	52.7	35.8	26.6	49.3	7	1892-1898
Oresco.....	10.3	15.9	25.8	44.4	56.5	66.3	70.9	68.6	59.8	46.3	29.4	18.2	42.7	27	1872-1898
Davenport.....	20.0	25.0	35.0	50.0	61.0	71.0	75.0	73.0	65.0	52.0	27.0	26.0	49.3	27	1872-1898
Delaware.....	13.3	18.1	30.9	46.7	57.9	68.8	71.6	68.8	61.8	46.5	29.5	21.4	44.6	8	1891-1898
Decorah.....	12.5	17.5	32.0	49.2	59.8	68.4	70.3	67.5	63.2	48.5	30.3	21.0	45.2	6	1893-1898
Denison.....	20.0	23.5	32.1	49.3	60.0	68.7	72.8	70.7	65.3	48.4	31.7	22.3	47.0	6	1893-1898

MEAN TEMPERATURE—CONTINUED.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Means.	No. years.	Record in-cluded be-tween de-cades low.
Des Moines.....	18.0	23.0	26.0	53.0	61.0	71.0	75.0	72.0	65.0	53.0	37.0	26.0	49.0	21	1878-1898
Dubuque.....	17.0	23.0	23.0	49.0	60.0	70.0	74.0	72.0	64.0	51.0	34.0	26.0	47.8	26	1873-1898
Dysart.....	16.4	23.2	24.5	53.3	66.6	76.2	80.7	77.9	66.9	57.1	37.6	23.9	51.4	10	1879-1883
Elkader.....	13.0	19.1	30.9	48.0	60.6	69.5	73.7	70.2	62.2	48.2	31.3	21.5	45.7	18	1879-1898
Fairfield.....	15.4	23.7	33.6	49.1	59.1	70.1	74.8	70.4	64.1	51.4	35.3	25.0	47.6	13	1879-1898
Fayette.....	15.7	20.1	30.9	47.2	56.8	68.4	71.7	68.7	63.6	48.3	31.0	23.9	45.4	9	1890-1898
Ft. Madison.....	22.8	27.8	37.7	51.7	63.2	73.4	77.7	74.5	66.3	53.1	38.4	27.4	51.2	51	1848-1898
Garnavillo.....	9.0	15.3	26.4	43.4	56.8	65.4	69.1	66.6	58.2	46.1	28.9	16.6	41.8	7	1890-1886
Galva.....	15.4	20.0	23.8	49.3	60.2	69.2	73.5	70.0	65.5	48.8	30.5	22.4	46.6	6	1893-1898
Glenwood.....	17.7	23.7	33.3	48.8	59.9	70.5	74.1	72.1	62.4	49.0	33.9	24.9	47.5	29	1867-1898
Grand Meadow.....	14.9	19.7	31.1	47.2	57.5	66.9	70.1	67.9	63.0	48.2	30.5	22.5	45.0	8	1891-1898
Greenfield.....	20.1	23.0	34.0	50.8	59.6	70.8	74.0	72.2	66.1	51.8	33.8	22.6	48.2	8	1871-1898
Grinnell.....	18.3	23.2	33.1	50.7	59.4	70.2	72.7	70.0	63.4	47.2	34.5	24.8	47.3	9	1890-1898
Grundy Center.....	14.9	20.0	32.1	48.8	58.1	69.8	71.8	69.8	63.8	49.8	30.6	23.0	46.0	8	1891-1898
Guttenberg.....	14.0	20.0	28.7	44.5	57.8	66.7	70.6	67.9	59.5	47.1	31.9	19.3	44.0	23	1864-1885
Hampton.....	13.9	18.0	29.0	46.8	57.0	67.9	71.7	68.7	62.4	48.1	29.7	21.0	44.5	9	1890-1898
Hopeville.....	20.4	23.8	35.1	51.6	60.0	70.2	73.5	72.1	67.1	53.1	34.3	25.9	48.9	8	1891-1898
Independence.....	14.8	20.3	30.4	47.2	59.4	67.0	71.2	68.1	60.0	47.1	32.0	21.1	44.9	37	1861-1898
Indianola.....	19.3	25.0	36.6	52.1	60.4	70.8	74.2	72.8	67.0	54.6	36.0	25.7	49.5	7	1892-1898
Iowa City.....	21.0	24.9	35.2	50.8	59.6	71.2	73.9	70.7	65.2	50.6	35.8	27.0	48.8	9	1890-1898
Iowa Falls.....	12.2	17.2	31.7	47.0	59.0	68.7	72.3	69.0	62.5	48.0	29.7	21.0	44.9	6	1893-1898
Keokuk.....	23.0	29.0	38.0	52.0	63.0	72.0	77.0	75.0	67.0	55.0	39.0	30.0	51.7	28	1871-1898
Keosauqua.....	22.4	26.6	39.0	53.0	62.1	73.8	76.4	74.1	68.0	54.6	37.1	27.2	51.2	7	1892-1898
Knorrville.....	23.4	24.2	37.0	52.8	62.8	72.0	75.5	73.0	67.2	51.8	36.2	25.5	50.1	6	1893-1898
Larrabee.....	16.5	20.5	30.6	48.5	57.6	69.6	72.2	70.2	64.5	49.2	30.0	22.6	46.0	8	1891-1898
Logan.....	20.3	24.1	34.0	51.9	60.8	71.7	74.8	72.1	66.8	52.3	34.9	26.8	49.2	34	1890-1898
Marshalltown.....	18.0	21.7	31.9	49.1	58.6	69.1	72.4	70.6	64.9	50.7	32.6	23.6	46.9	7	1891-1898
Mason City.....	14.7	16.7	31.0	50.2	58.2	68.1	71.7	68.5	63.8	47.2	28.2	19.9	44.8	5	1894-1897
Marion.....	17.0	23.2	35.4	54.4	63.0	72.7	76.8	73.5	66.7	51.6	33.8	26.4	49.8	6	1891-1896
Maquoketa.....	17.8	25.3	35.7	48.3	60.7	71.1	75.7	71.6	64.7	53.2	35.8	25.3	48.8	6	1891-1898
Mechanicsville.....	15.3	20.2	34.8	49.2	59.0	69.6	73.0	71.2	63.6	49.4	32.2	25.2	46.8	5	1892-1896

Monticello.....	15.4	21.4	31.9	48.8	59.2	68.8	72.9	70.0	61.7	48.5	33.2	22.1	46.1	45	1854-1898
Mt. Ayr.....	22.2	26.5	36.4	52.2	62.2	71.0	75.2	73.0	63.2	53.0	35.4	25.5	50.1	6	1892-1898
Nashua.....	15.4	26.0	41.8	54.9	54.9	64.7	70.6	66.8	57.1	48.2	30.6	18.1	41.8	9	1879-1897
Newton.....	16.3	21.7	34.4	48.6	60.5	70.6	74.8	71.8	62.9	50.2	32.7	21.9	47.2	12	1878-1896
Osage.....	12.4	16.0	28.5	44.8	56.1	66.5	69.9	66.1	59.8	43.7	26.4	19.1	42.4	8	1891-1898
Oskaloosa.....	17.6	22.4	34.3	50.2	59.9	69.9	74.7	71.1	64.5	50.6	35.7	26.2	48.1	16	1883-1898
Ottumwa.....	22.6	25.2	38.9	53.5	63.0	72.9	75.6	73.8	67.9	53.0	36.4	27.7	50.9	5	1894-1898
Ovid.....	22.6	24.8	37.4	52.6	61.3	71.3	75.8	73.7	67.8	52.7	35.7	26.5	50.1	6	1893-1898
Panama.....	18.5	21.2	33.0	50.7	59.2	69.3	73.3	71.0	65.0	49.5	31.8	25.2	47.2	6	1891-1896
Rock Rapids.....	14.8	17.0	29.8	48.6	57.2	68.4	72.8	69.8	63.0	47.5	28.0	19.7	44.7	6	1898-1898
Sac City.....	18.9	19.7	31.2	49.7	59.0	71.7	76.1	72.5	63.9	51.2	33.1	23.4	47.1	20	1870-1898
Seymour.....	23.2	26.5	38.8	53.4	61.8	71.8	75.6	74.0	68.2	54.2	36.8	31.0	51.3	5	1893-1897
Sioux City.....	18.0	21.0	31.0	51.0	59.0	70.0	74.0	71.0	65.0	50.0	32.0	26.0	47.3	10	1899-1898
Sibley.....	12.7	18.0	30.4	48.2	57.8	67.3	70.8	67.6	62.2	48.2	27.8	19.4	44.2	6	1893-1898
Smithland.....	14.4	17.0	28.5	44.5	63.1	67.9	70.7	70.9	66.8	49.5	26.9	16.4	43.9	4	1879-1882
Spirit Lake.....	13.7	19.2	31.7	49.1	59.3	68.9	74.1	71.7	65.3	47.5	27.4	21.1	45.7	5	1894-1898
Toledo.....	18.4	22.0	35.0	50.9	61.6	70.5	73.8	71.4	64.6	49.1	33.0	23.3	47.8	5	1894-1898
Vinton.....	17.2	21.9	32.4	48.9	58.8	69.9	73.2	69.6	63.2	49.2	32.8	24.6	46.8	9	1890-1898
Villisca.....	20.6	24.5	36.2	52.0	61.4	71.0	74.0	71.0	65.2	50.7	34.2	24.0	48.8	6	1893-1898
Washington.....	21.5	25.4	35.2	52.3	61.0	73.7	75.6	73.1	66.7	52.3	25.6	26.3	49.9	8	1890-1898
Waterloo.....	16.7	21.9	32.9	50.3	63.5	72.8	77.8	74.4	66.0	52.0	26.6	23.8	49.0	20	1893-1898
Webster City.....	16.3	19.3	31.3	46.7	57.8	69.8	73.8	71.0	65.2	50.2	31.0	21.3	46.1	6	1891-1898
Wesley.....	15.1	22.2	34.4	54.7	60.3	74.7	77.6	75.7	66.4	54.2	35.8	22.8	49.5	13	1879-1891
West Bend.....	15.6	19.7	29.9	46.2	58.4	68.2	72.2	69.2	61.5	45.6	27.7	17.9	43.8	6	1893-1898
Winterset.....	19.3	23.6	34.2	51.4	60.4	70.4	73.4	71.4	65.9	51.6	33.7	25.6	48.4	8	1891-1898
Means.....	17.1	21.7	33.2	49.5	59.7	70.0	73.7	71.1	64.3	50.2	32.8	23.6	47.2	.....	.....

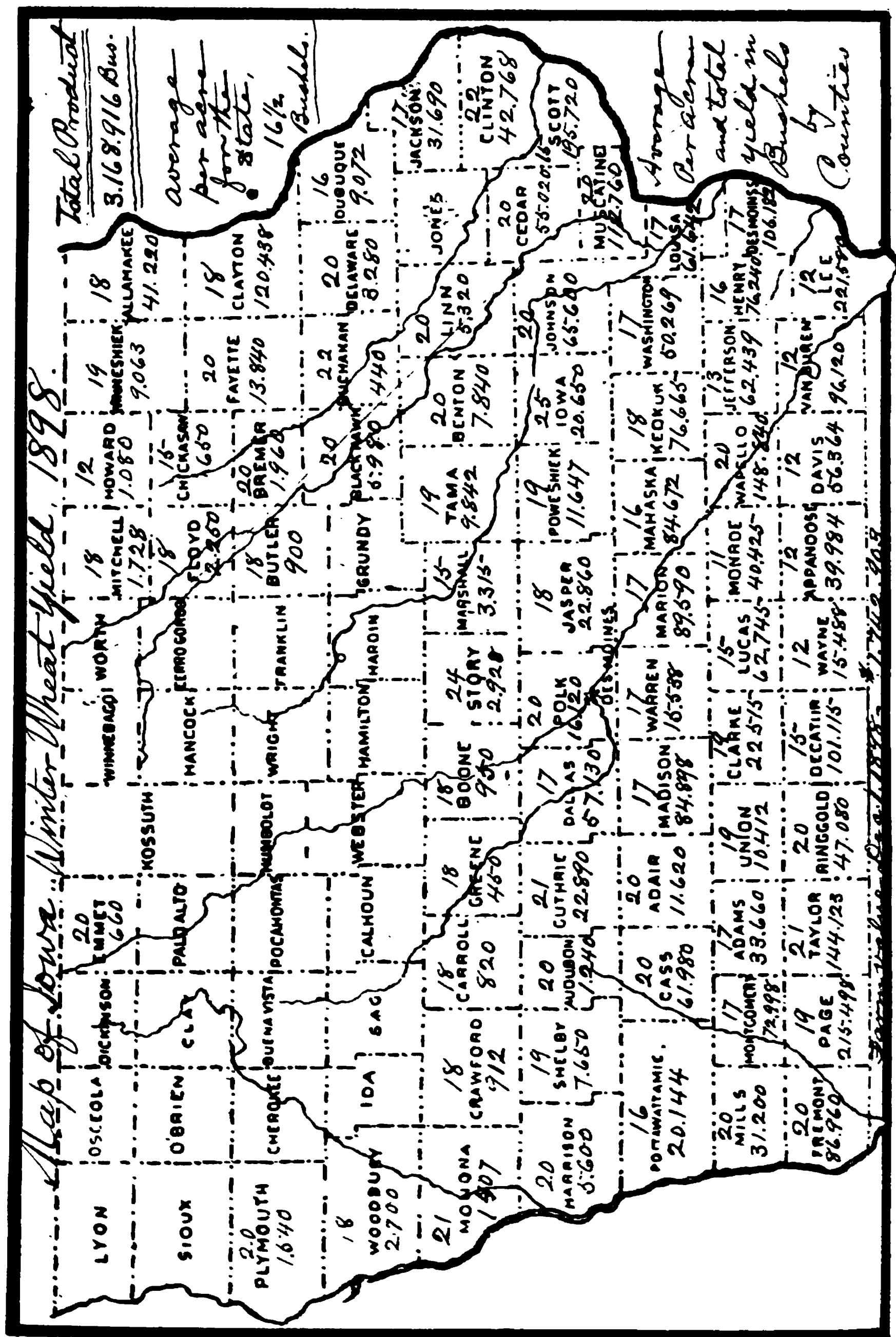


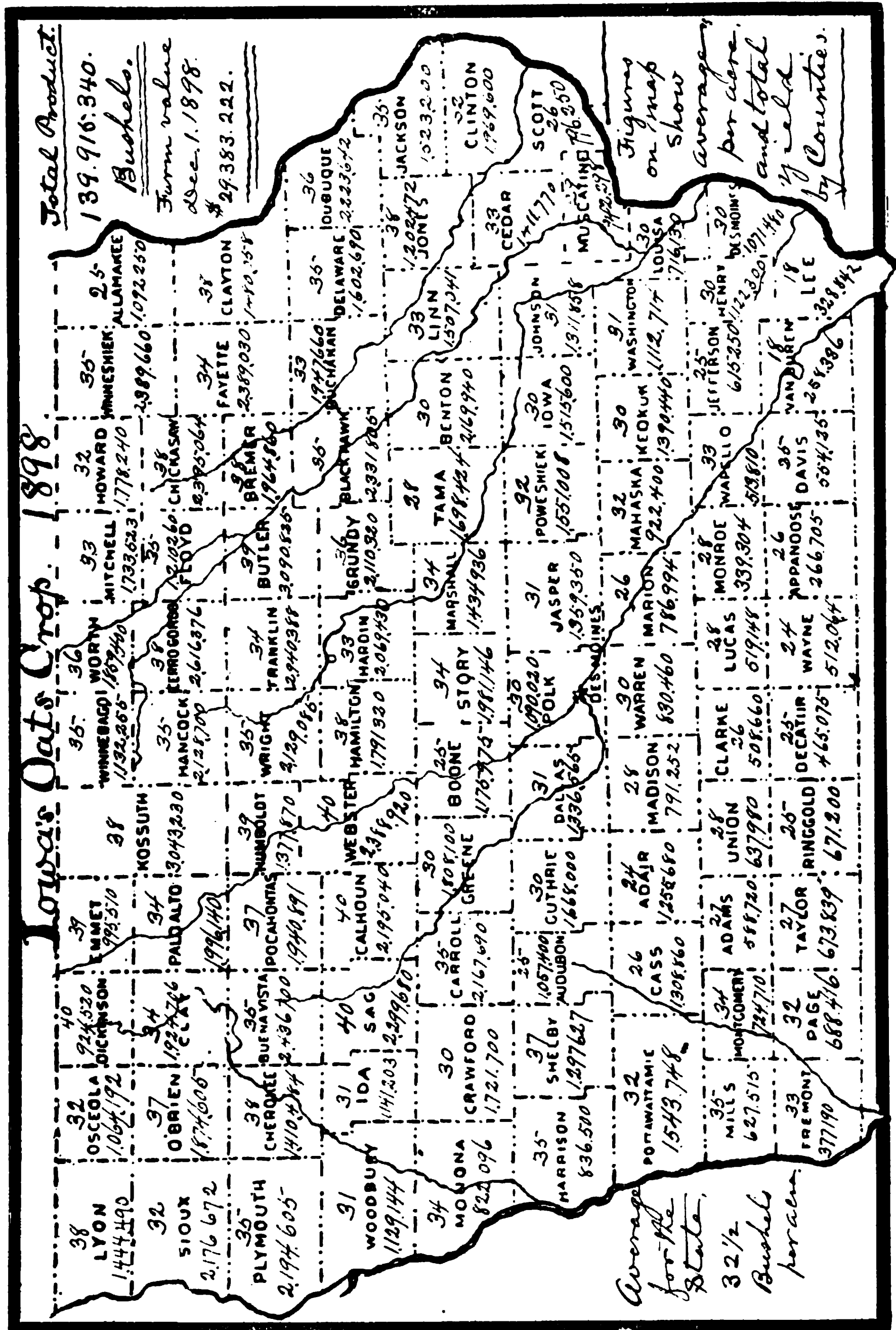


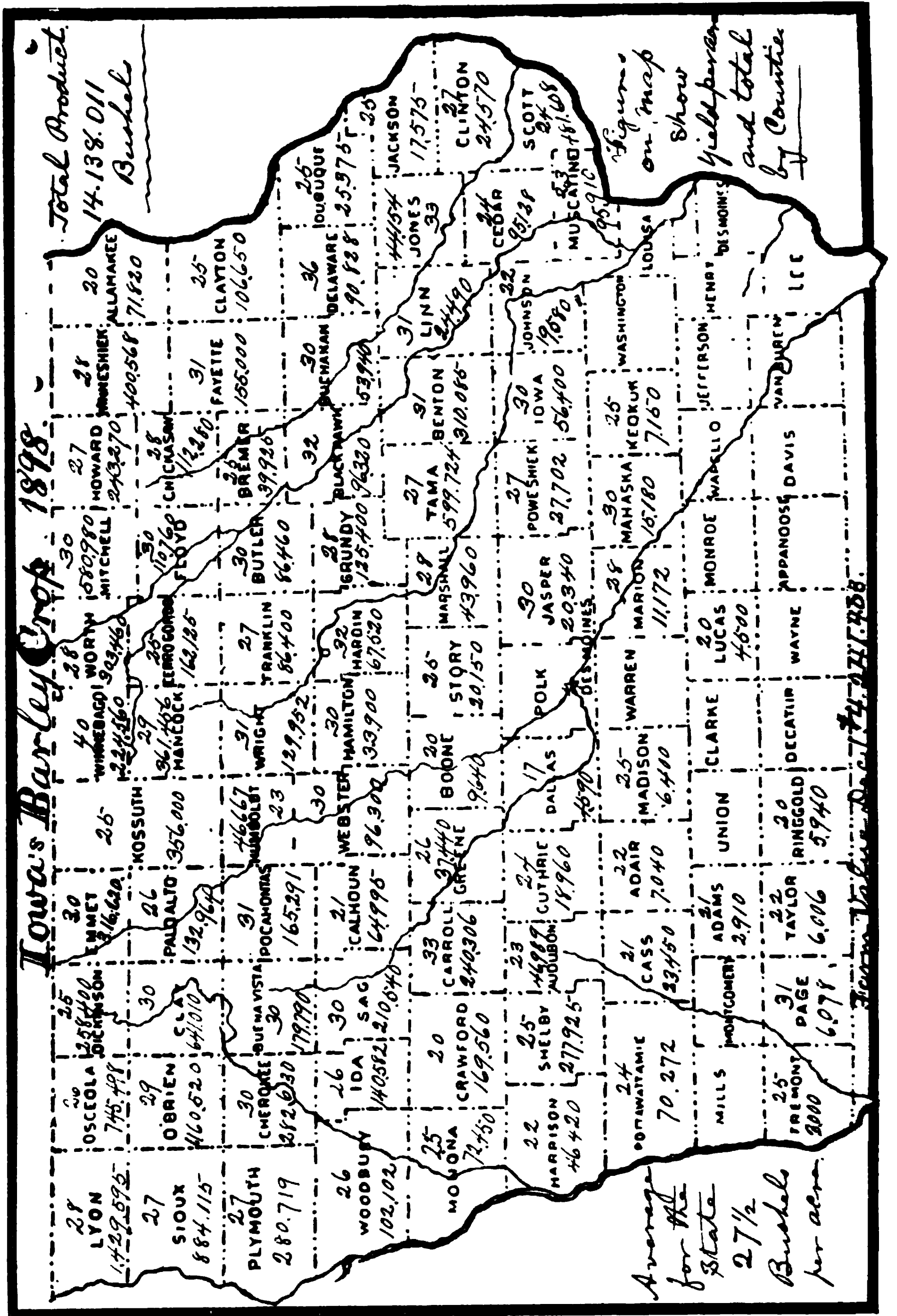
Iowa's Spring Wheat, 1898

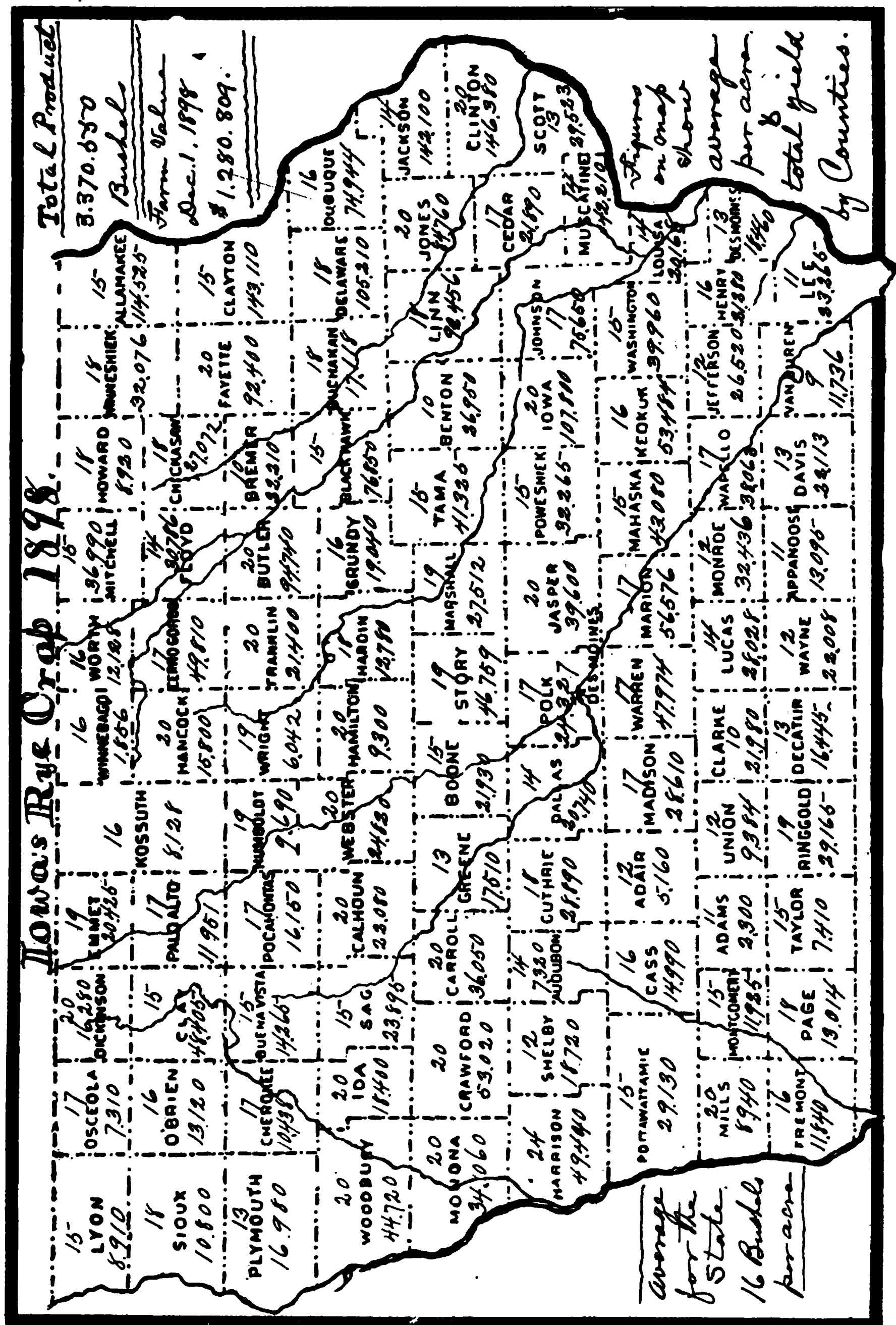
14	LYON	15	OSCEOLA	17	EMMET	16	WINNEBAGO	16	WORTH	14	HOWARD	18	MINNESOTA	16	ALLAMAKEE	Total Product	
	1369.802		759.180		579.885		376.928		101.880		35.840		108.000		33.600	19.152.352	
15	SIoux	15	O'Brien	14	PALMISTO	17	MANCOCK	16	FERROCONG	14	FLOYD	17	FAYETTE	17	CLAYTON	Bushels	
	2258.715		620.070		382.125		242.675		34.768		36.918		26.845		37.434	Average per acre for the State	
15	PLYMOUTH	17	CHEROKEE	15	BUENA VISTA	16	POCAHONTAS	18	WEBSTER	17	HAMILTON	17	GRUNDY	18	BLACKHAWK	14.8	
	1527.900		682.788		279.780		219.852		385.020		130.806		167.440		25.745	Bushels	
17	WOODBURY	14	IOA	16	SAG	20	CALHOUN	19	WEBSTER	17	HAMILTON	17	GRUNDY	18	BLACKHAWK	14.8	
	901.408		474.18		277.280		160.880		110.789		58.718		99.025		83.504	Bushels	
19	MONONA	16	CRAWFORD	16	CARROLL	15	GREENE	15	BOONE	17	STORY	16	MARSHALL	14	BENTON	14.992	
	324.691		812.400		286.560		48.375		48.210		66.640		128.288		86.670	Bushels	
17	HARRISON	16	SHELBY	16	WAGONER	14	CUTHRIE	16	DALAS	16	POLK	16	JASPER	16	POWESHIEK	14.992	
	647.088		549.888		409.512		164.640		79.520		147.040		10.720		11.610	Bushels	
15	POTAWATTAMIE	12	CASS	11	ADAIR	12	MADISON	13	WARREN	14	MARIAN	14	MAHASKA	13	KEOKUK	14.992	
	867.795		226.872		121.710		106.716		72.468		47.404		14.392		5.040	Bushels	
14	MILLS	14	MONTGOMERY	14	ADAMS	22	UNION	13	CLARKE	12	LUCAS	16	MONROE	16	WAPELLO	Average per acre and total yield by Counties	
	257.560		247.002		97.020		8.294		3.120		5.40		8.25		1.080	Bushels	
14	FREMONT	14	PAGE	15	TAYLOR	12	RINGGOLD	11	DECATUR	12	WAYNE	12	APPANOOSE	7	DAVIS	Bushels	
	93.940		112.728		10.335		2.220		1.650							Bushels	
																Bushels	

Form Value Dec. 1898 = 9.939.928.

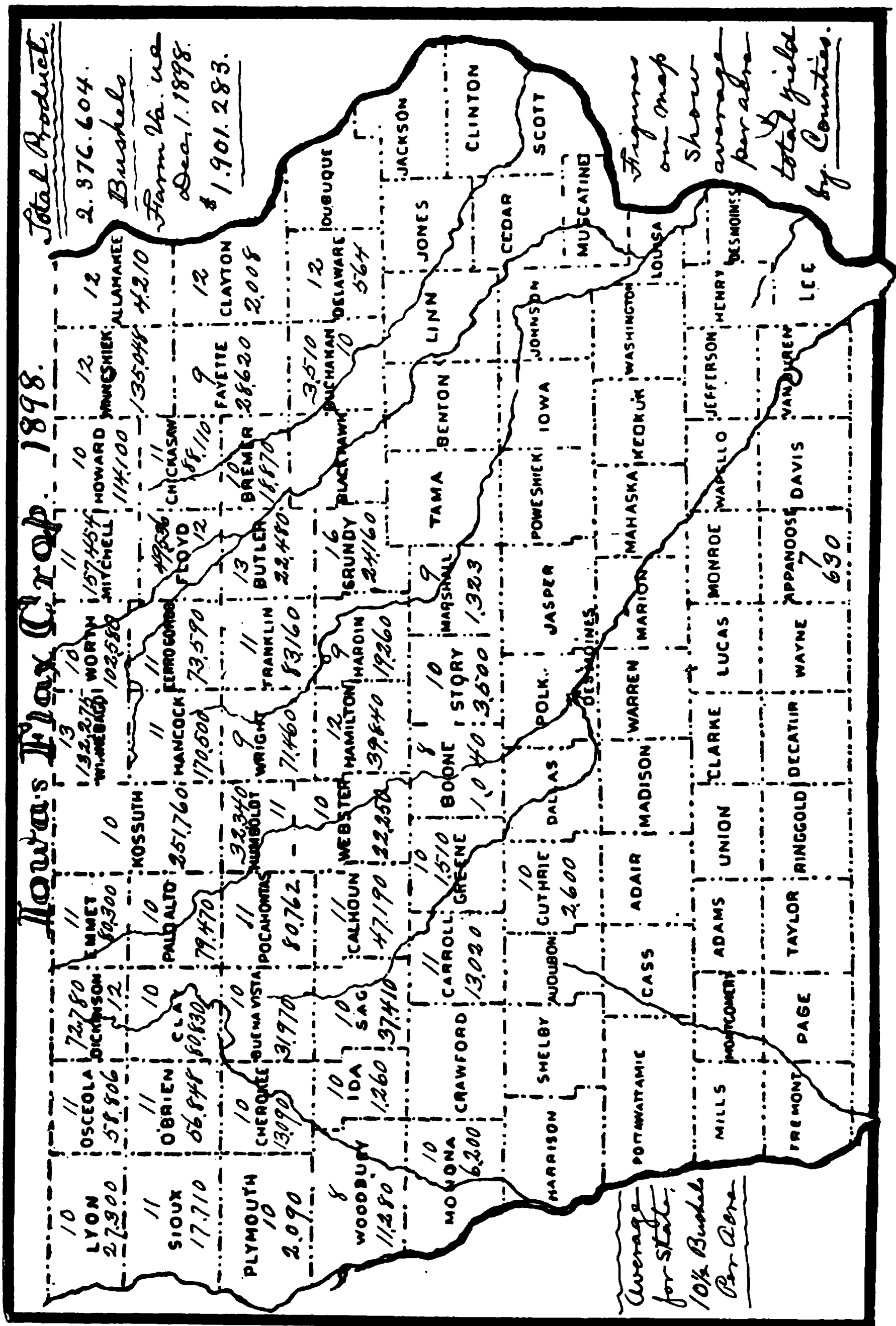


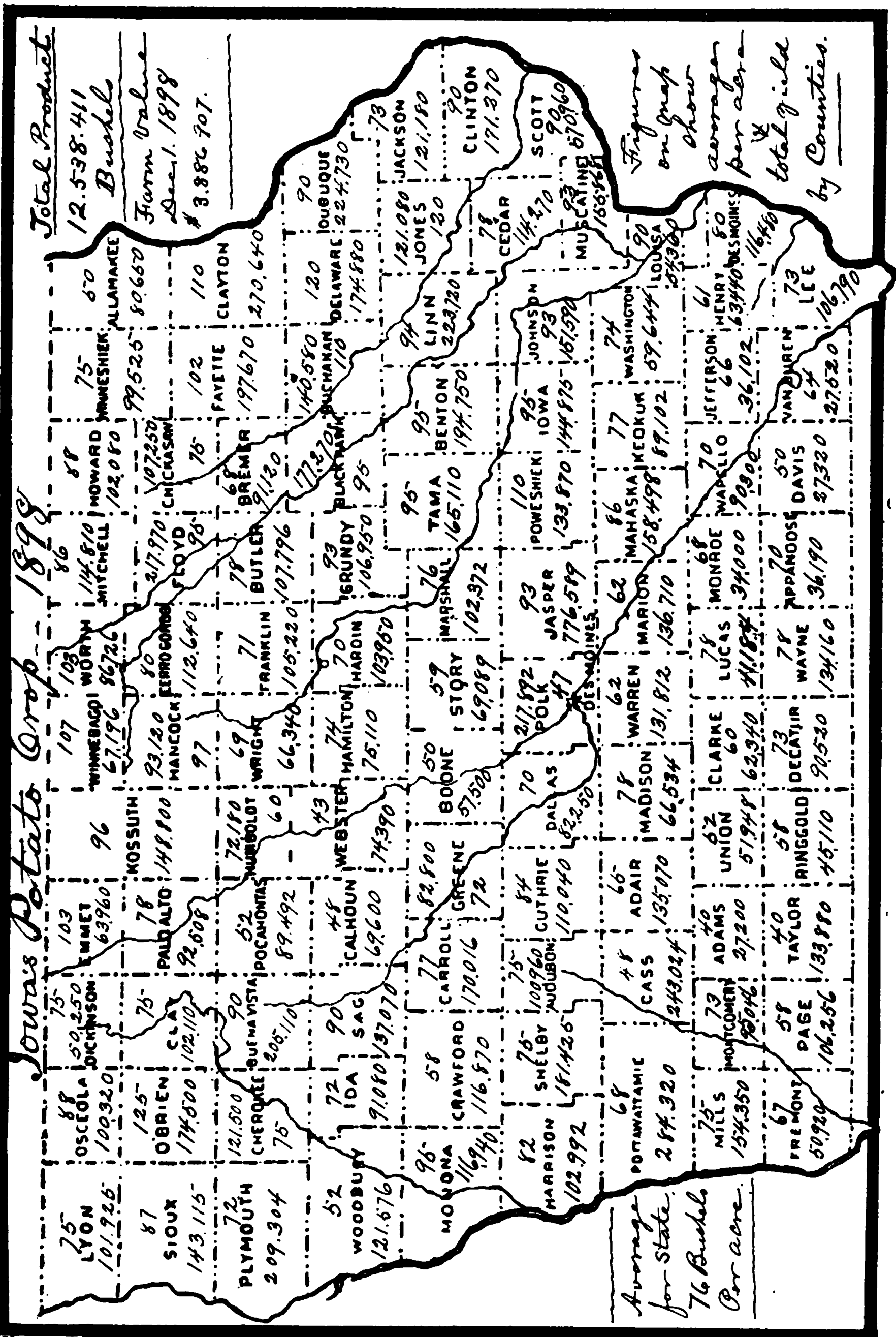




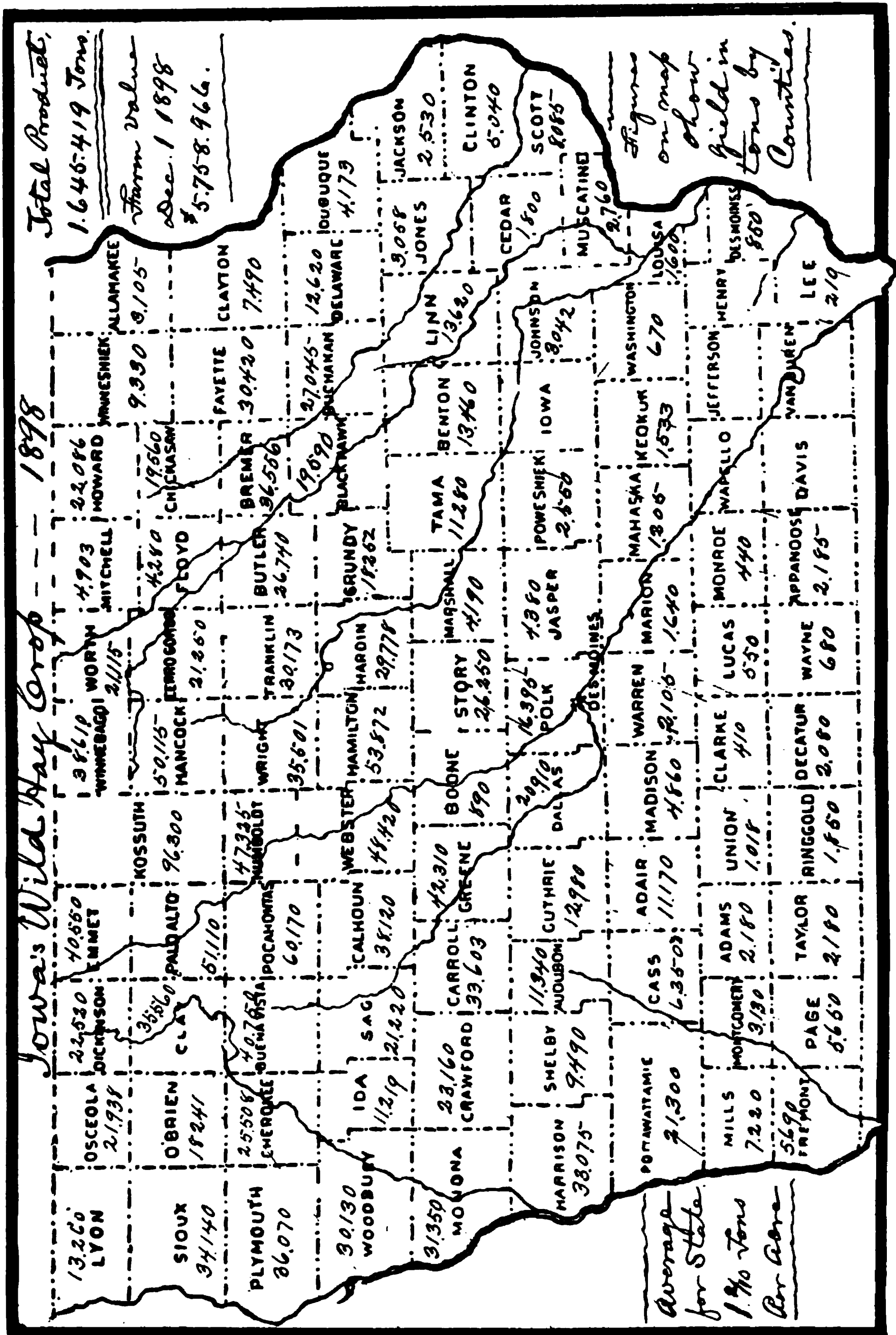


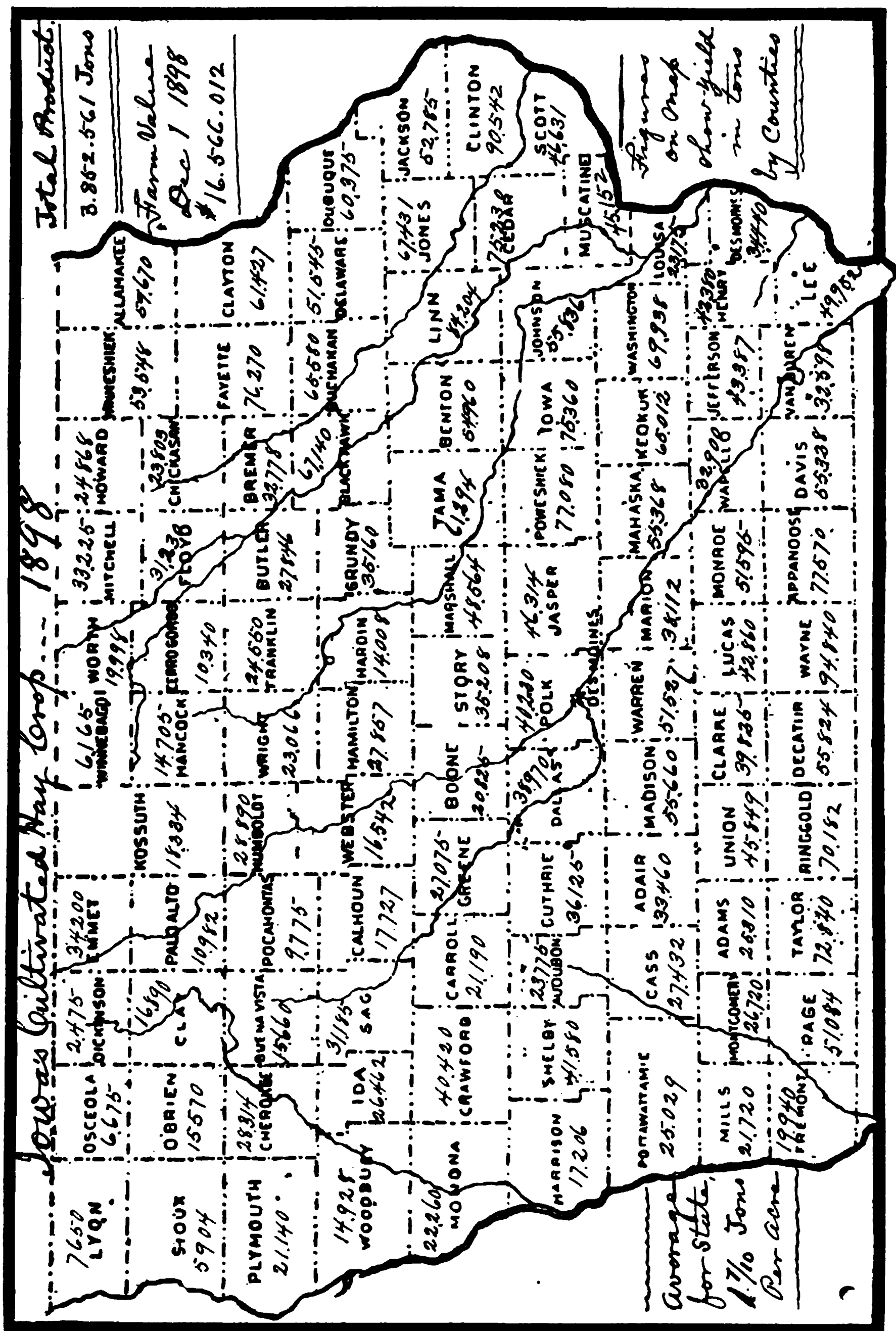














Cedar R.	90	48	75
Cedar F.	94	48	79
Clinton	91	50	77
Davenport	91	50	78
Delaware	93	45	70
Denison	94	48	70
Des Moines	94	49	85
De Soto	91	49	74
Dubuque	96	49	74
Eldora	99	47	80
Galva	90	48	79
Grinnell	93	48	79
Grundy	96	48	81
Guthrie	94	48	76
Independence	96	49	80
Iowa City	93	48	85
Iowa Falls	92	48	77
Linn Co.	93	48	86
Logan	91	53	80
Maquoketa	96	48	86
Marshall	96	48	86

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